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Journal of the Society of Arts.

FRIDAY, DECEMBER 13, 1867.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at Eight o'clock:—

December 18.—"On the Principles that Govern the Future Development of the Marine Boiler, Engine, and Screw Propeller." By N. P. Burgh, Esq., C.E.

Cantor Lectures.

The first course for the present session is "On Art, especially including the History and Theory of Sculpture," and is being delivered by by Richard Westmacott, Esq., R.A., F.R.S., Professor of Sculpture in the Royal Academy, as follows:—

December 13th.—Lecture II.—The subject of the Introductory Lecture illustrated, by a general survey of the history and practice of Sculpture in ancient times, especially among the Greeks.

December 20th.—Lecture III.—The subject continued, including a review of the mediæval and more modern schools, to the close of the eighteenth century.

The lectures commence each evening at eight o'clock, and are open to members, each of whom has the privilege of introducing two friends to each lecture.

Artisans' Reports on the Paris Exhibition.

The Reports of the Artisans selected by the Council to visit the Paris Exhibition are now in the press, and will be published in a few days.

Technical Education.

The Council feeling the great importance of this subject, have resolved to hold a Conference at the Society's house, on the 23rd and 24th January next, the particulars of which are explained in the following circular:—

Society for the Encouragement of Arts, Manufactures,
and Commerce, Adelphi, London, W.C.,
9th December, 1867.

Technical Education.

Sir,—I am directed by the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce, to invite your (Chamber of Commerce or other body) to appoint its President or other representative, to attend a Conference which is to be held here, on Thursday and Friday, the 23rd and 24th of January next, to consider and suggest what measures may be taken to promote the industrial and scientific education of the various classes of the community.

The Conference will commence its sittings on Thursday, the 23rd of January, 1868. The Chairman of Council will take the chair at 12 o'clock precisely.

At as early a period as possible, the Council will issue to each gentleman who accepts their invitation to the Conference a programme of the probable course of its proceedings; and, to enable the Council to do this in a satisfactory manner, I am to request you to inform me, with the least possible delay, whether a representative from your [ ] will be able to attend the Conference; whether your [ ] has any special resolutions to suggest, or any particular points to which it desires to direct attention; what general measures for the promotion of education it may conceive to be requisite; and what institutions of a specific character are needed in your own neighbourhood to give the greatest practicable facilities for the acquisition of knowledge applicable to your local industries.

The object of the Conference is to ascertain, not merely what the Society of Arts, Manufactures, and Commerce, but what the nation at large can do to promote technical education among the workmen, the foremen, the overlookers, and the employers in Arts, Manufactures, and Commerce; and it is hoped that an expression of opinion by this Conference may tend in some degree to diminish the difficulties with which the solution of this vital question of national education is at present confessedly surrounded.

I am, your obedient servant,
P. Le Neve Foster, Secretary.

The foregoing circular has been forwarded to:—

- The Mayors of the Towns which are the principal seats of manufacture in the United Kingdom.
- The Presidents of the Chambers of Commerce and Agriculture.
- The Presidents of all Societies and City Companies which have co-operated with the Society in respect of Education or Art-workmanship.
- The Presidents of Institutions in Union with the Society of Arts.
- Her Majesty's Inspectors of Schools, Factories, Mines, and Collieries.
- Professors at University, King's and other Colleges.
- The Examiners of the London University.
- The English Jurors at the Paris Exhibition of 1867.
- The Society's Judges in Art-Workmanship.
- The Society's Examiners in Education.
- The Society's Visiting Officers.
- The writers of letters to the Schools' Inquiry Commission.

And many other gentlemen connected with education.

Members of the Society taking a special interest in this subject are invited to attend.

Examinations, 1868.

In addition to the prizes announced in the Programme of Examinations, the following are offered:—

The Worshipful Company of Coach and Coach Harness Makers offer as prizes—

1. A Silver Medal in Freehand Drawing; and
2. A Bronze Medal in Practical Mechanics;

To any candidate, being a workman or apprentice employed in the coach-making trade, who obtains the highest number of marks, with a certificate, in these subjects respectively.

The medals will be presented by the Master of the Company in open court.

Institutions.

The following Institution has been received into Union since the last announcement:—

Portsea Island Young Men's Christian Association.

Subscriptions.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

Food Committee.

The Committee met at three o'clock on Wednesday afternoon, the 20th of November, when were present—the Right Hon. Henry Austin Bruce, M.P. (in the chair), Mr. W. Ewart, M.P., Mr. Harry Chester, Mr. Samuel Gurney, M.P., Mr. Bagshaw, Mr. J. T. Ware, Mr. C. S. Read, M.P., Mr. McLagan, M.P., Mr. G. F. Wilson, F.R.S., Mr. E. C. Tufnell, Mr. W. H. Michael, Mr. E. Wilson, and Mr. E. W. Hollond.

Captain Warren, R.N., brought before the notice of the Committee a cooking apparatus, on the plan which had been adopted by him, and practised for the last two years, in cooking for the army at Aldershot camp, &c., in which great economy of fuel and saving in the meat cooked were claimed. It was stated by Captain Warren that rations for 120 men were cooked by this apparatus, on a large scale, at a cost of 3d. per day for fuel; whilst he alleged there was a saving of two ounces in the pound of the meat cooked. The weight of one of these cooking apparatuses, as they were in practical use for the Abyssinian expedition, was only 146lbs., and they could be transported on the backs of horses or mules. He considered this a good method of preparing food already cooked for distribution to the poor, to whom the cost of fuel was an object. He added that he could construct an apparatus of this kind weighing not more than 4 cwt., placed upon wheels, which would be capable of cooking food for 500 persons.

In reply to inquiries by the Committee, Captain Warren stated that the apparatus was equally efficient on a smaller scale, and was adapted for private use in houses, particularly where boilers were already fitted, from which steam could be supplied, or where hot plates existed. He did not regard it so much as a plan of which the poorer classes could avail themselves; but for unions or workhouses the saving would be great.

The principle of the apparatus having been minutely explained by Captain Warren and Mr. Michael, and commented upon by various members of the Committee, the Chairman thanked Captain Warren, on behalf of the Committee, for his interesting communication.

Dr. Medlock, accompanied by Mr. Bailey and Mr. J. Graham, attended to give information to the Committee, relative to the preservation of meat, poultry, fish, &c., by the application of bi-sulphite of lime.

Dr. Medlock said the process was a very simple one. For the last two or three years he had devoted a good deal of time and attention to the preservation of meat, and the result of his experiments was, that the bi-sulphite of lime was the best preservative he had hitherto found. His experiments were made principally during the hottest weather of last summer; and he found by treating joints of meat with bi-sulphite of lime they kept sweet two or three times longer than they would do under ordinary circumstances. Mutton, which would not have kept for three days in summer, remained good for a fortnight after this treatment. The cost of the process was a mere bagatelle. To preserve meat in the carcass, it was necessary to inject the bi-sulphite into the arteries through the aorta, immediately after the animal was slaughtered and the blood expelled. A carcass so treated would keep five or six times longer than if not so treated, and there was no taste or flavour whatever imparted to the meat by the preparation; and by this means they could hang meat in summer as long as they could in winter. By many persons it was considered the appearance of the meat was improved by this treatment. He stated that the operation could be performed by unskilled persons; and nothing was easier than the manipulation of the process. There was no tendency in the material to solidify, unless the preparation was made of the greatest strength, and then it deposited the neutral sulphite of lime. In the treatment of a joint of meat it was simply necessary to dip it into the solution of half bi-sulphate of lime of 1·050 specific gravity and half water. It was not at all necessary to remove the preparation from the joint before cooking. There was a certain amount of penetration of the liquid into the joint, but it was perfectly harmless, and there was no perceptible taint or taste of the bi-sulphite when the meat so treated was eaten. He had eaten poultry and joints of meat at his own table, and there was not the slightest taste of lime.

Mr. McLagan inquired what was the difference between this process and that by means of sulphurous acid gas.

Dr. Medlock replied that the preservative agent was sulphurous acid gas, and bi-sulphite of lime was the most convenient practical mode of applying the gas. The quantity of lime that would be eaten in dining off a joint treated by this process would be wholly inappreciable; probably not more than a quarter of a grain.

The Chairman said the committee would be glad to have Dr. Medlock's views with regard to the applicability of this process to the preservation of meat coming from long distances to this country.

Dr. Medlock said as yet he had had no opportunity of testing the efficiency of his process in the case of meat sent from foreign parts; but he had no doubt whatever as to its practicability. He had kept a piece of neck of mutton from the end of May last till the present time. The meat remained perfectly sweet, but the fat had a strong odour of tallow. He had from time to time cooked portions of joints treated by this process, and they were perfectly sweet. Those joints were soaked in the preparation for twelve hours.

Mr. E. Wilson inquired whether Dr. Medlock had given consideration to the difficulty which at present exists in transporting meat in a fresh state from South America and other distant parts of the world to this country.

Dr. Medlock replied he had not done so at present. Last year, during the hottest summer weather, a number of turkeys, fowls, and joints of lamb were sent to him from Canada. They were six weeks in coming, and when the casks were opened, the contents were perfectly sweet and good. That was in July last year. The various articles were packed in the casks and covered with the liquor; and he need not say the appearance of the poultry was not improved thereby; but when they were wiped dry and dusted over with flour, they would have been perfectly saleable in a poulterer's shop.

The Chairman inquired at what cost the turkeys, &c., reached Dr. Medlock.

Dr. Medlock replied that the turkeys averaged ten or twelve pounds weight each, and the cost of them in Canada was about 2s. 6d. each. The cost of conveyance he did not know. He thought if the turkeys, &c., had been soaked for a time in the preparation, and packed dry, it was probable they would have had a better appearance when they arrived. By this means he had no doubt that a large trade in poultry might be established between this country and Canada.

Mr. Bailey said he believed the cost of treatment by this process, and freight from Canada, would be covered by a farthing per lb. for joints and poultry.

Dr. Medlock thought that was an extravagant scale.

Mr. Bailey replied that included freight from Canada.

If a turkey weighing 9 lbs. cost 2s. 6d., it could be sent to this country for 2s. 6d. plus 9 farthings.

Dr. MEDLOCK went on to say that its largest application had hitherto been to the preservation of butchers' meat. It often happened that a butcher had a quantity of meat left unsold on a Saturday night, and it was a great boon if, by a simple and ready process, he was able to preserve the meat sweet till the Monday. He held testimonials from many of the largest butchers in London and other places. He apprehended this process might be applied to the transporting of meat from distant parts of the kingdom, and from foreign countries where large supplies exist, and also to domestic purposes at home, for preserving meat, &c., which in the hot weather soon became tainted and bad. He was not aware that the process had been adopted with respect to provisions on board ship, but that was, in his opinion, another direction in which it would be highly beneficial. It was his intention, he added, to try experiments with joints of meat from foreign countries as soon as possible.

Mr. J. GRAHAM, the commercial agent for the process, gave information as to the practical results of the process as far as it had been yet introduced. He stated that, as a test of its efficiency, casks of beef had been sent overland from London (after being treated with bi-sulphite of lime) to Australia, South America, and Constantinople. They could not tell the result yet, but the experiment was intended to show that if meat could be sent there from this country in a fresh state fit for food, it could be sent from those countries here in the same condition.

Mr. MICHAEL inquired whether any experiments had been tried by the injection of carcases with the bi-sulphite.

Dr. MEDLOCK replied, it was tried with some lambs last spring. It had not yet been tried on a carcass so large as an ox. He added that no salt was necessary, though he thought the addition of a small quantity of salt to the liquor would improve the flavour of the meat. In the cases of injection he had mentioned he fancied he detected some slight taste of the lime in eating the meat. He thought the admixture of a little salt would tend to get rid of that flavour; but the quantity of salt would be so small as in no way to impart the character of salted meat. About half-a-pound of salt to four gallons of the liquor would be sufficient in the process of injection, the taste of which would be scarcely perceptible. Some friends who partook of the lamb which had been injected did not detect anything different in the flavour of the meat. He had pieces of mutton which had been preserved since last May, and there was not the least taint beyond a tallowy odour. The pieces were soaked in the solution for about twelve hours, and then hung up without being re-dipped. There was no necessity, he said, to dip if injection were adopted. He had eaten meat, three months after it had been killed, preserved by this process, and it was perfectly sweet and good, and retained its flavour in a remarkable manner. In hot climates, and in this country in hot weather, it was desirable to apply the process as soon after the meat was killed as possible, as the effect of the treatment was to keep the meat in a sound condition. He did not say that it would stop putrefaction when once it had commenced.

Mr. TUFNELL inquired if he had estimated the amount of lime which a leg of mutton would take up by this process?

Dr. MEDLOCK replied that the meat, steeped in the solution for ten minutes and then hung up, would not absorb more than three or four grains of actual lime.

The CHAIRMAN inquired whether, if this system was as successful as was anticipated, it might supersede the necessity of sending meat from Australia and other colonies in a cooked state, such as was now exported?

Mr. GRAHAM replied that there had been no results of experiments upon meat brought from a very long distance as yet; he was not therefore in a position to answer the question just put. He could state more particularly what had taken place among the butchers of England. When he first took this matter up, there was the usual amount of prejudice to be overcome. The first objection raised by the butchers was that it would impart a soddened appearance to the meat. On his rebutting that objection, it was urged again that the solution would give a limy taste to the meat; and many butchers refused to try the experiment on a large scale till they had tested the result by eating a joint so treated at their own tables. One West-end butcher, doing a very large trade amongst the aristocracy, at his (Mr. Graham's) solicitation, had one of his large tanks emptied for the purpose of experimenting upon the process, which he continued for three weeks, testing the results very carefully. Legs of mutton, pieces of beef, &c., were put into the solution by the dozen, and that was continued for some time without any complaint that there was anything different in the meat on the part of the customers. During the whole of the three weeks there was no complaint either as to the appearance or the flavour of the meat. The experiments were made in the month of July last, immediately after the Sultan's departure from London. On one occasion the same butcher said to him "I will put it to another test. Here is a piece of the best quality of beef, which I know will not remain sweet till Sunday; I will have it steeped in the liquor, and have it cooked for my own table on Sunday. If it is all right then, I will give you my testimonial." He did not let his family know that the meat had been treated with the bi-sulphite; but the joint was cooked and eaten by his wife and family, who stated that they made an excellent dinner, and did not notice anything different in the meat. The same person, on a subsequent occasion, on Mr. Graham calling to ascertain further results, said, "My foreman is the best advocate of your system that you can have;" and the foreman assured him that he applied the solution every day to joints which he thought would not keep good till the morrow. With regard to the appearance of the meat, it was the fact that the week before last he visited a butcher who had taken out a license for this system, and found him applying the bi-sulphite to beef by means of a painting brush, which he said gave a better appearance to beef, but that it did not to mutton. With regard to mutton, the same person told him that he had had but one complaint, that a shoulder of mutton tasted a little tallowy. He had seen them rubbing over the outside of beef with the liquor, to improve, as was said, the appearance of the meat. He had received a testimonial from a large butcher in Scotland, stating that he considered by this process the meat was improved in respect of appearance and made tender eating. His object at an early stage of the discovery was to get the system introduced extensively in Newgate-market; and finding a large wholesale carcass butcher who was not prejudiced against a new thing, he asked him to give the plan a thorough trial. The experiment was made in the first instance upon kidneys alone for a fortnight, and afterwards upon sweet-breads and joints of lamb. The opinion of the salesman expressed to him was, "I believe your liquor will do all you propose; I will use it, and will allow you to make reference to me." Mr. Graham went on to state that during the hot weather of last summer he went into the market every day. He went there on Wednesday, the 14th of August, when the thermometer rose to 121 degrees in the sun, and great quantities of meat were spoilt by the excessive heat on that day. In the same month a Scotch butcher, who sent for a sample of the solution to experiment with, hesitated to apply it to some carcases of lamb which he was about to send to London, but he tried it upon some joints of lamb he had in his shop, and which he sent up with the carcases. These joints were packed up in hampers with the other meat which had not been touched with the bi-sulphite, and when they arrived in London on Monday morning the carcases of lamb were all bad, whilst the joints that had been brushed over with the bi-sulphite were perfectly sweet and good, and were readily saleable. He had one of those joints of lamb for dinner on the following Tuesday, and everyone who partook of it pronounced it to be excellent eating lamb. About the same time he paid a visit to a wholesale dealer, whose business consisted entirely in the sale of carcases of veal. On the 14th August, that remarkably hot day, the dealer said to him, "Here are eight sides of veal; do you think your preparation would keep them good till to-morrow?" He replied that was something for a man to undertake with the thermometer at 121 degrees; however, a cloth was procured, and the sides of veal were treated with the solution, and the next morning the meat was as sweet and sound as possible. After that result the salesman in question authorised him to make use of his name as a reference to the efficacy of the treatment in a very critical case. A few days subsequently the same dealer sent a number of calves' heads to Aberdeen. In summer time they could be sent there at a profit, for the purpose of being cured for making mock-turtle soup. Having covered twenty-five heads with the solution, he said he was quite confident they would reach their destination quite sweet; but he had some doubts with regard to the effect it might have upon the scalding of the heads to remove the hair from the skin. He subsequently saw the person in Aberdeen to whom the twenty-five heads were consigned, and he stated that he cured them in the usual manner, and that he noticed no difference in their appearance in any respect, the whole of them having reached him in perfectly good condition. Another curer, who received fifty heads untreated from London about the same time, informed him that the whole were condemned, and were obliged to be buried. On the 12th August last there was an immense quantity of *green* meat in the market. In one instance a gallon of this preparation was sent for and applied to a quantity of necks, shoulders, and legs of mutton, and the joints so treated kept sweet and good, whilst those which were not so treated were obliged to be thrown away the next day. There was, he said, one point of importance in connection with this preparation, viz., that the meat should be sweet at the time the solution was applied, for if decomposition had commenced in the interior of the joint it was impossible for the solution to arrest it. Meat was so precarious an article that he had been told by a venison dealer that on some occasions one haunch would arrive perfectly sweet, while the fellow haunch would be tainted and bad. The difficulty was to get a quantity of meat always in the same condition. With reference to the question put by one of the Committee, as to the length of time after slaughtering at which the solution should be applied, he would state that it did not matter what time elapsed between the killing of the meat and its being treated with the solution so long as the meat was sound at the time the bi-sulphite was applied. He had no doubt the process of injecting the whole carcass was the surest method of preservation. He thought injection would be preferable, especially in hot weather, to meet the requirements of the wholesale dealers.

A conversation took place with respect to the altered appearance that was imparted to the meat by the use of sulphurous acid gas, and Dr. Medlock stated that, in the case of the turkeys and lamb, the legs of the former were, when cooked, of a slightly higher red colour than usual, but the breasts retained their whiteness; the appearance of the lamb he saw was unaltered. When it was not practical to inject the meat in the carcass in the case of meat coming from a long distance, he proposed that the process of soaking in joints should be adopted. It was necessary that the solution should be of the temperature of 100 degrees, or at blood-heat, at the time of injection. The quantity of lime that would be eaten on dining off a joint of meat, either injected with or dipped into the bi-sulphite, would be quite inappreciable, and could not possibly produce any injury to health.

Mr. E. W. Hollond inquired whether this process was not adopted for bringing Canadian partridges to this country.

Dr. Medlock replied that he was not aware of it. The bi-sulphite had not been known in its practical application to these purposes more than two or three years.

The Chairman having thanked Dr. Medlock, Mr. Graham and Mr. Bailey for the information they had given, the committee adjourned.

On Tuesday, the 26th of November, a Sub-Committee met and witnessed experiments with Medlock and Bailey's Preservative Fluid, of which the following is a minute. The experiments took place in a slaughter-house of Mr. John Evans, butcher, 61, Southampton-row, Russell-square, London.

There were present Messrs. James T. Ware, C. S. Read, M.P., P. McClagan, M.P., W. H. Michael, Members of the Food Committee of the Society of Arts; P. Le Neve Foster, Secretary; Messrs. A. B. Northcote, F.C.S., &c., Wentworth L. Scott, F.C.S., F.A.S.L., &c., Dr. C. Pryce, Dr. Henry Medlock, Ph.D., F.C.S., &c., Messrs. Vincent Bailey and J. Graham.

The times of meeting were Tuesday, November 26th, 10.30 a.m., and Wednesday, November 27th, 9 a.m.

The temperature of slaughtering-house on Tuesday, was 46·5, and on Wednesday, 43·0.

The representatives of the Society of Arts Food Committee and of the patentees having met at Mr. Evans's slaughter-house as above stated, the animals (viz., four wether sheep) were killed in the usual manner, by one of Mr. Evans's slaughtermen, assisted by another experienced butcher in the employment of Mr. Nicklinson, salesman, of Newgate-market.

The operations were conducted in the manner set forth in the accompanying table, the flesh, hides, and viscera being throughout subjected to the scrutiny and observation of the gentlemen present.

Two of the sheep were injected by two competent operators from the Middlesex Hospital, under the immediate superintendence of Dr. C. Price, of 46, Mornington-road, Regent's-park. A small quantity of water, at the normal blood temperature, was first injected, in order to cleanse the vessels from any remaining blood; afterwards the bisulphite was used, as set forth in the table.

The other two sheep were simply skinned and hung up, each carcase being distinctively labelled.

The hides of the animals were subsequently bisulphitised on the inner surface only.

At the conclusion of these operations the slaughter-house was locked up, and the key handed to Mr. J. T. Ware, Member of the Food Committee.

On Wednesday, November 27th, at 9 a.m., Mr. Ware, Dr. Medlock, Mr. Vincent Bailey, Mr. Wentworth Scott, and Mr. J. Graham, met at the slaughter-house, when the first-named gentleman unlocked the door, and the whole injected carcase, No. 1, was washed over with the solution A.

The injected carcase, No. 2, was divided in halves, the first half (experiment No. 2) being cut up into joints, dipped in solution A, and hung up.

A similar plan was adopted with the second half (experiment No. 3), except that the joints were closely packed in a cask, which had been previously rinsed out with solution A, an imperial pint of which was added before heading up the same.

The carcase of the third sheep, which heretofore had remained intact, was divided into halves. The first half (experiment No. 4) was cut up into joints, which were soaked for ten minutes in solution A, and then severally hung up. The remainder (experiment No. 5) was hung up, undivided, being first treated in a similar manner.

The fourth sheep was likewise divided in halves, each half being cut up into joints:—Those of the first half (experiment No. 6), having been soaked ten minutes in

No. of Animal.	Time of Coagulation of blood.	Weight of			No. of experiment.	Parts of animal operated upon.	MODE OF TREATMENT.		In what state left.	OBSERVATIONS.
		Carcass.	Hide.	Offal.						
1	Min. 2	lbs. 77	lbs. 14	lbs. 39	1	Whole carcass.	November 26th. Injected with solution B.	November 27th. Washed over with solution A.	Hung up.	Eleven pints of the solution B were injected into the aorta. A considerable quantity of the liquid escaped from the vena cava, showing perfect injection.
2	1¾	92	15	47	2	Half carcass, cut up.	Injected with solution C.	Dipped in solution A.	Hung up.	No. 2 sheep similarly injected with solution C.
					3	Half carcass, cut up.	Injected with solution C.	Dipped in solution A.	Packed in cask marked No. 3, with addition of a pint of solution A.	
3	2¼	86	15	45	4	Half carcass, cut up.	Skinned and hung up.	Cut up, and joints soaked 10 min. in solution A 24 hours after slaughter.	Joints.	
					5	Half carcass.	Ditto.	Soaked 10 min. in solution A.	Hung up (half carcass).	
4	1¾	100	15	44	6	Half carcass.	Ditto.	Cut up, and joints soaked 10 min. in solution A 24 hours after slaughter.	Joints packed in cask mark'd No. 6, with addition of a pint of solution A.	NOTE.—The livers and kidneys of the injected sheep were partially blanched, but after hanging up twenty-four hours regained, in a great measure, their natural colour.
					7	Half carcass, except leg and neck.	Ditto.	Steeped 2½ min. in solution A, being first cut up in joints.	Joints packed in cask mark'd No. 7, with addition of a pint of solution A.	
					8	Leg.	...	Wetted all over by means of a cloth saturated in solution A.	Hung up.	
					9	Neck.	...	Hung up in its natural state, untreated in any way	Hung up.	

Note.—Solution A means Medlock and Bailey's patent bisulphite, undiluted. B means solution of ditto—bisulph, 1 quart; water, 1 quart; salt, 2 ozs. C means solution of ditto—bisulph, 1 quart; water, 3 quarts; salt, 4 ozs.

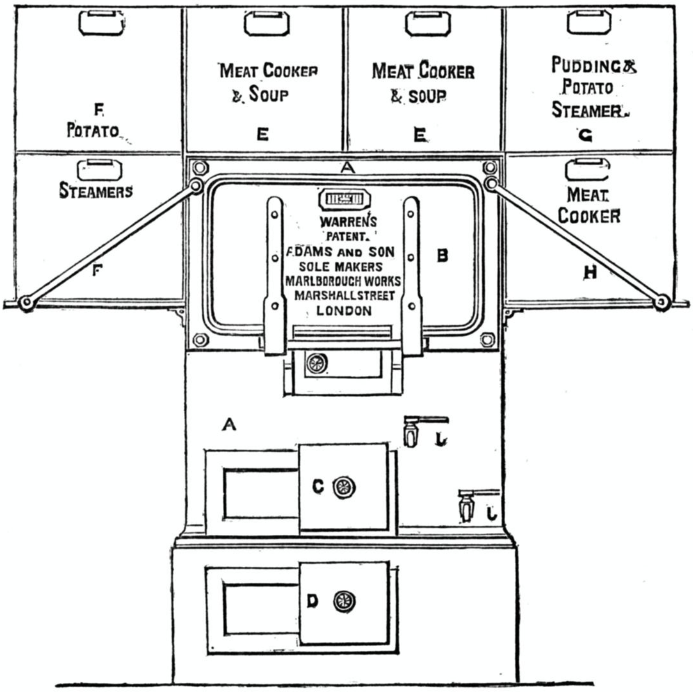
solution A, were packed in a cask in the same manner as experiment No. 3. The joints of the other half (experiment No. 7), with the exception of the leg and neck, were steeped in bisulphite A for 2½ minutes, and put into a cask as before. The leg of mutton (experiment No. 8) was thoroughly wetted all over, by means of a cloth saturated in solution A, the operation being repeated about ten minutes after the first application, and the joint then hung up. The neck of mutton (experiment No. 9) was hung up in its natural state, untreated in any way.

The operations being completed, the whole of the meat specimens were conveyed in a cart to the residence of Mr. Samuel Gurney, M.P., No. 20, Hanover-terrace, Regent's-park, where they were placed in an out-house, kindly lent for their reception, under the superintendence of Mr. J. Graham, the door being locked, and the key left in the charge of Mr. Gurney. The meat was subsequently removed to the Society of Arts, where it now remains.

On Friday, the 29th of November, the members of the Committee attended, by invitation of Captain Warren, at Messrs. Adams, of Marshall-street, Golden-square, to witness a trial of Captain Warren's apparatus for cooking for the army and other large bodies of persons.

The apparatus consists of two parts; first, the stove proper, and, secondly, the hot air and steaming vessels in connection with it. A (p. 56) is the stove, constructed of wrought iron, and containing two boilers, for supplying boiling water for breakfasts, teas, and washing-up purposes, and for furnishing steam to the cooking vessels; these boilers are so constructed that the fire acts directly on the water contained in them, no brick-work whatever being required either in their construction or in the fixing.

The fire, after passing through the boilers (which by their peculiar shape form the flues), is then conducted entirely round a roaster or oven, B, placed over the lower part of the boilers, one of which is continued up behind the back of the oven to the top of the stove. C is the door of the furnace, which is made to slide either to right or left. D is the ash-door, which also regulates the draught into the furnace, the ashpit being partly filled with water—the boilers are supplied with water from behind; the filling-pipes forming also vents, and being furnished with whistles at the top to announce, if necessary, a deficient suuply of water. J J the draw-off cocks. E E are two of the patent cookers, having inner linings; the bottom of the outer cases communicate with the steam-boiler below by means of brass ferrules and cones fitting closely to prevent any escape of steam. The covers of the cookers are made hollow so as to contain the steam which passes up through the case of the cooker, leaving the interior free from steam, so that the meat is cooked by hot air only. Soup is also prepared in these cookers; the meat is placed on a perforated tray above the water or stock, and not in it; and the soup receives the droppings of the meat. Thus the meat loses less in weight than by the ordinary method of boiling, and the soup is improved in quality and flavour. F F is the potato cooker, and is fitted inside with six potato cans or pots, holding 20lbs. each, or in all 120lbs. The potatoes are cooked by steam from the lower boiler (the upper one being reserved for the other cookers), the whole being thoroughly done within 45 to 60 minutes, according to the kind of potato. H is a cooker similar to E and E, in which meat is generally cooked without soup; and on testing the weight of the meat cooked in this pot it was found, by weighing it together with the gravy that had run from it, that scarcely any appreciable loss had resulted, a joint weighing 14lbs. not having lost 4oz. G is a steamer for steaming puddings, and is constructed to hold twelve or fourteen meat puddings or dinners for twenty-four men. It can also be used for steaming carrots, parsnips, and other vegetables. The oven B is thoroughly ventilated,



and will roast full rations for twenty-two men, including potatoes browned under the meat. It will also bake bread; 12lbs. to 16lbs. being thoroughly baked in two hours.

When the apparatus is not in use, the cookers and kettles can be taken off, and placed upon a shelf, the side-plates lowered, the stove then occupies a space of 2 feet 2 inches wide, 3 feet 7 inches high, and 1 foot 10 inches deep.

The following is a statement of what was done:—

Army Cooking Apparatus.

Fire lighted . . . . . . 10·30 a.m.

Fuel used, 1 lb. wood and 18 lb. coals.

Abyssinian Apparatus.

Fire lighted . . . . . . 11·30 a.m.

Fuel used, 16lbs. wood and 2lbs. camels' dung.

	Weight.		Put in.	Taken out.	Weighed.	
	lb.	oz.			lb.	oz.
Leg of mutton Warrenized (Pat. cooker)	9	11	10·55	2 p.m.	9	6
Do. same sheep (boiled in water)	9	13	10·55	,,	7	8
Do. (roasted in oven) .	8	14	11·30	,,	5	12
Bacon (Warrenized)...	4	9	12·15	1·45 p.m.		
Turbot, ditto	5	0	12·30	,,		
Two fowls (boiled) ...	...	...	12·35	,,		
Two do. (Warrenized)	...	...	12·30	,,		
Two ditto (roasted in oven)	...	...	12·50	,,		
Potatoes (steamed) ...	...	...	12·50	,,		
Sprouts & cauliflower	...	...	1·0 p.m.	,,		

The time specified by Captain Warren for dishing-up was 1·30. Everything was ready at that time, but was not dished-up until two o'clock, which will account for the time in cooking, &c.

Cantor Lectures.

"On Art; especially including the History and Theory of Sculpture." By Richard Westmacott, Esq., R.A., F.R.S.

Lecture I.—Friday, December 6.

The lecturer expressed the pleasure it afforded him to accept the invitation of the Council to deliver a few lectures before the members of the Society of Arts. He had had but a short time to consider the subjects he should select, and he had decided to adopt one suggested by the address of the Chairman of the Council, at the opening of the session. It was the want of general education in art; and he (Mr. Westmacott) hoped to show the extreme importance and value to the public of this acquisition. The fallacy of the opinion that any one unacquainted with the true principles of art can be a competent judge of works of art was gradually gaining ground. It was admitted that, to judge of the merits and value of any of the ordinary products of industry, required some education in the particular branch of science or skill to which the object belonged; but in the matter of art every one thought himself capable of forming a correct judgment. It appeared to be the opinion of some that if a picture or statue afforded pleasure to, or satisfied its admirer, and possessed qualities that hit his peculiar liking or fancy, such a work was to him a work of beauty and merit. There could not be a greater mistake. It was a distinct question. It was one of liking—not of merit or beauty. A vulgar, commonplace work of art could not be other than vulgar, however and by whomsoever it might be admired or preferred. But knowledge added to enjoyment. For instance—a musical work might be performed in a mixed company, and nearly all would listen to it with a certain amount of pleasure; but how much greater would be the gratification, and how much higher the enjoyment, to educated musicians, who could not only listen to the melody, but enter into the train of thought, and appreciate the power of combination, evidenced by the composer, in producing a work of character, expression, and beauty. If this were true of music it must be equally true of painting or sculpture—for, what words and rhythm were to the poet, and sounds to the musician, colour and lines were to the painter, and form to the sculptor. To attain to anything like a just appreciation of art required education; and none but true artists (he meant those who really understood the true principles of art), whether professional or amateur, could be considered as trustworthy judges and guides in matters of art; for it was not sufficient that the object should afford pleasure to constitute it beautiful or worthy. This was illustrated by the affection of a mother for her child, which was utterly irrespective of its beauty. No one could look around him and see the multitude of miserable little objects, which were so naturally the objects of affection to their parents, and say that, because they were loved (or, as in art, liked and admired), the poor, afflicted children were therefore beautiful. It was not only the deficiency of art education in this country, but the want of efficient encouragement for the production of high and noble works of art, that was to be regretted. Artists in England did not seem to aspire to anything heroic and noble in their works, as did those of Greece and the great artists of Italy in times past, but they appeared rather to work down to the present low standard of public taste. In England how few works showing really high aspirations were to be met with among the thousands of pictures produced every year. This, doubtless, was in a great measure due to their non-appreciation by the public when produced. In Greece and Italy the reverse was the case. The people had the natural sensibility which made them capable of appreciating the noble, the beautiful, and the heroic in conception; and the artists of those countries were obliged to work up to the standard of public knowledge and public taste; and the result was the great works which happily had been preserved, not only for our instruction and study, but also for the delight of cultivated minds through all ages. The lecturer adverted to a feeling some persons entertained that we had no subjects calculated, like the myths and poetry of the Greeks, to afford opportunities for high and beautiful art. This he denied, and spoke of the splendid sources of inspiration to be found in the Bible, both the Old and New Testaments; grander, he thought, than anything in the mythologies of ancient Greece and Rome; and he hoped that as the public taste improved, these subjects would become more and more studied by the higher class of artists. One advantage to be derived from education in the principles of art would be to enable people to judge for themselves, and to free them from the dictation of self-elected critics—too often very incompetent to act as guides of public taste. They would then not feel bound to believe a thing to be good or bad simply because they had seen it so stated in print; but, having knowledge themselves, they would understand the true principles upon which to judge the works produced. He was glad that the wish to possess such knowledge appeared to be a growing desire on the part of the public, and he hoped to assist those who favoured him with their presence to attain a knowledge of why some of the works of the great masters, particularly in sculpture, were truly beautiful, and worthy of the admiration that had been so universally accorded to them.

Fourth Ordinary Meeting.

Wednesday, December 11th, 1867; William Hawes, Esq., F.G.S., Chairman of the Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Cox, Frederick, 100, Newgate-street, E.C.
Crewe-Read, Commander Offley Malcolm, R.N., Llandinam, Montgomeryshire.
David, Charles W., Cardiff.
Garrett, Richard, Carleton-hall, Saxmundham.
Haysmar, David, Portway-house, Weston, Bath.
Headlam, Alfred, Wavertree, Tunbridge Wells, Kent.
Humbley, Michael, Gwersyllt, Wrexham.
Jay, Captain William Chickhall, 33, Cavendish-sq., W.
Levett, Robert, Packington-hall, Lichfield.
Llewellen, Thomas, M., Newport, Monmouthshire.
Lloyd, John, Huntington-court, Hereford.
Payne, W., 6, Salisbury-court, E.C.
Prideaux, Charles Grevile, Q.C., Brick-ct., Temple, E.C.
Scarborough, Thomas H., 5, Bloomsbury-square, W.C.
Smith, David, Siddal, Halifax, Yorkshire.
Wilson, Charles Thomas, Brynnewydd, Swansea.

The following candidates were balloted for, and duly elected members of the Society:—

Cox, William Sands, F.R.S., Dosthill-house, Wilnecote, near Tamworth.
Flavelle, Henry, 14, St. Stephen's-rd. Westbourne-pk., W.
France, James Robert, 98, Rotherfield-street, N.
Hendriks, Frederick, 30, Palace-gardens-terrace, Kensington, W.
Morris, Augustus, 118, Cannon-street, E.C.
Pagliardini, Tito, Portman-street, W.
Rabbeth, George, Edinburgh-house, 13, Cornwall-road, Paddington, W.
Robert, Dr. C. Russell, Park-house, Hampton-wick.
Tindal, C. G., Marchfield-house, Bracknell, Berks.

The Paper read was—

ON INDUSTRIAL AND SCIENTIFIC EDUCATION; WITH NOTES ON THE SYSTEMS PURSUED, AND THE WORKS PRODUCED, IN CONTINENTAL SCHOOLS, AS EXEMPLIFIED IN THE PARIS EXHIBITION, AND SUGGESTIONS FOR THE ESTABLISHMENT OF TRADE SCHOOLS IN ENGLAND.

By Ellis A. Davidson, Esq.

Lecturer on Natural History, Engineering Drawing, and Architecture, in the City Middle Class Schools; late Head Master of the Government Schools of Science and Art, Chester and Crewe.

Dr. Lyon Playfair, in a most important communication which he recently addressed to Lord Taunton, on the Industrial Arts of Great Britain, as exemplified in the Paris Exhibition, states that "with very few exceptions, a singular accordance of opinion prevailed that our country had shown but little inventiveness, and made but little progress in the peaceful arts of industry since 1862." All who are sensible of Dr. Playfair's comprehensive knowledge of the subject, his warm interest in everything that concerns the intellectual development of our country, and his unswerving truth, must thank him for thus calling public attention to a great national deficiency, and so enabling us at once to devise means which shall prevent our being intellectually lowered in the scale of nations, and which shall bring about a system of education so healthy as to have a practical bearing on the trade, manufactures, and commerce of this country.

The Exhibition of 1851 showed us that in ornamental art, as applied to manufactures, we were behind other nations, and the notion obtained that we were essentially a nation of shopkeepers, a nation devoid of taste; but on investigation, it soon became evident that we were not without taste, but without art education. The Department of Practical Art was established, teachers were trained and spread far and wide over the country, art was made popular; and it will no doubt be admitted that the seeds thus broadly sown have fructified fairly, and that in the comparatively short period that has elapsed great and permanent improvement has been made. But it would now appear that a corresponding progress has not taken place in the scientific and mechanical branches of industry. Whether this is the result of the utterly unpractical character of most of our schools is a question now requiring solution; and it is with the hope of eliciting opinions, far more important than my own, that I have ventured on these remarks, based upon an attentive study of the systems pursued, and the works produced in some of the schools of the Continent, as shown in the Paris Exhibition of 1867.

Before, however, adverting to the training a workman receives abroad, it may be advisable to glance at the early education and apprenticeship of an English artisan. As a boy, he attends a national or British school, where he *may* be, and in most cases *is*, well taught. Still, the subjects and the standards for examination being fixed by the Council office, the master cannot afford that time should be devoted to other branches; in fact, some find a difficulty in allowing even one hour per week for drawing; neither is the master always qualified to give, nor do the pupils as a rule remain in the school long enough to receive, even the elements of technical education: so that, excepting in the cases of some of the ragged and industrial schools, where gardening, shoemaking, wood-chopping, and perhaps carpentering, are practised, the boys leave school without having received any notions of practical work, or of the sciences on which the mechanical arts are based—thinking of chemistry as a mysterious art, by which the druggist compounds medicine; of a locomotive as a machine which somehow or other draws the train along; and of architecture as the ordinary work of the bricklayer and carpenter.

As a rule, chance, not talent or predisposition, guides the placing of the boy in some occupation by which he is subsequently to gain a livelihood, parents being naturally anxious to send their sons "out" so that their earnings may contribute to their support.

Let us follow the boy, and see him placed in an engineer's or railway works—he is at first a mere sort of errand boy or fag, being, in fact, fit for little else—he is subsequently placed in one of the departments, his instructor being the man under whom he works; but this man has his own work to attend to, and has not time to teach, and even if he had, could only teach the merely manual part, his whole knowledge having been picked up from the man under whom he had worked when an apprentice, and from the men with whom he has since been associated. When the work is finished it has to pass the foreman of the department, who is in many cases uneducated in the scientific principles on which the machines around are constructed, and whose duties certainly leave him no time (even if he were competent) to give instruction to the apprentices or men. The apprentice becomes in time a journeyman—by dint of sobriety and good conduct he may even become a foreman to guide others; and thus we have had what has been called the "rule of thumb," namely, one man learning from the other, carried on from generation to generation.

But let us take the case of a young "gentleman apprentice," who is to be an engineer, and who has had what is termed a "good education" in a private or perhaps in one of our public schools. He has spent many hours in classics, has learnt mechanics and chemistry from books—as he learnt Euclid—and his powers of drawing have been cultivated to the extent of manufacturing "views on the Rhine," "ruined castles," &c. In a few instances he may have drawn a steam-engine from a copy, but of the whole subject of solid geometry and projection, which form the very foundation of mechanical drawing, he is totally ignorant, as, indeed, he is of practical mechanics and the allied studies. Chemistry is scarcely better taught—but of this subject, not being my speciality, I must speak with diffidence, yet, I think, it may be safely asserted that a proper laboratory is as yet a feature in but few of our private or even public schools—and that unless a lad receives his chemistry lessons in the laboratory, and is allowed to work out experiments there, the time spent on book learning is almost wasted.

Happily, these remarks do not apply to all our public schools. The London University, King's College, the Scientific School in the College at Chester, Rugby, and recently, I believe, Harrow (and no doubt some others), form exceptions, which serve the more to show the prevailing deficiency.

The instruction in architecture which our youths, as a rule, receive whilst at school, is of much the same character, the ultimatum being a measured drawing of some complete elevation, without the slightest knowledge of architectural construction. Subsequently, on entering the office of either an architect or civil engineer, he has to attend to various office duties, to make tracings, &c., and to get knowledge in the best way he can, for in the office it is not as a rule any one's especial business to teach him, nor would the draughtsmen and clerks, even if they were qualified, have time for his instruction, so that he, like the young artisan, grows up to repeat only what has been done by others before him—not daring to invent, and, in fact, deficient of the necessary materials for invention.

But it was scarcely possible, in the Paris Exhibition, to represent adequately the progress which architecture has recently made in this country, which, it must be admitted, has been very great. Our architects have nobly followed in the track of human advancement, and availed themselves of the materials at their command. Our architectural requirements are different from those of any previous period. Our museums, our railways, our stations, and our bridges, have all rendered necessary the application of iron, hitherto but sparingly used in building, and our architects and civil engineers have in a short time achieved results which have conferred the greatest benefits on the community.

The Evening Classes for Science, which have been established under the auspices of the Department of Science and Art, are doing a great and useful work in offering to young men sound instruction, by properly certificated teachers. But it is scarcely the purpose of these classes to teach the elementary portions of the various subjects. These should form a part of the work of primary schools for all classes of society, and the science schools should take up the studies at a higher stage; when the pupils, more advanced in years, and with intellect improved by previous training, feeling in their daily avocations the use of the education they have received, and the necessity for extended knowledge, enter into the lessons with earnestness and appreciation; whereas to the adult, totally uninitiated, the necessary ruggedness of the first few steps of the road to learning, however much the tact and power of a clever teacher may enable him to smooth it, is still irksome, causing many to droop by the way, and to discontinue their attendance.

On the continent, under the heads of "Gewerb-Schulen," "Real-Schulen," and "Ecoles Polytechniques," institutions for practical studies have been in operation for many years past, and it is proposed to give in this paper a brief account of some of the results obtained, as exemplified in the Paris Exhibition; and subsequently to offer suggestions as to the promulgation of technical education in this country.

The respective sets of works executed by the pupils in the numerous schools of Germany and France show the great value attached to scientific drawing, and I intend to confine my remarks principally to the various branches of that study, devoting only a brief section of this paper to the consideration of the apparatus used in teaching animal and vegetable physiology. In the schools referred to, the studies are, as their names imply, of a real or practical character. The students learn, not only to make a drawing of a machine, but to prepare the working drawings from which a machine may be constructed; and, in many cases, to make the objects from the drawings. This must tend to show them the importance of accurate measurement and correct delineation. They learn, not only that the drawing must be exact, or it would be useless, but in turning or putting together the various parts, they do so with more readiness from having studied the construction on paper.

The collective exhibition of the Austrian Imperial Ministry of State contained numerous works and models, illustrating the courses of various studies carried on in this group of schools. The models will be referred to further on, and the scientific drawings mentioned here. The leading set of studies shows an excellent mode of combining several elementary manual processes with scientific instruction, thus avoiding a difficulty often experienced when instructing persons whose minds are in advance of their hands—who can "think out" a subject, but who cannot execute it. Many practical teachers will have observed the diffidence with which a student, who has been allowed to continue his geometrical drawing in pencil for a long period, begins to work in ink, and how frequently a drawing, scientifically correct, is spoiled by the tinting, either with the draw-pen or the brush. The system pursued in the Austrian schools seems calculated to overcome the manual difficulties contemporaneously with the elementary scientific instruction. When the geometrical figures have been correctly done in pencil, they are from the first inked, great neatness of line and accuracy of intersection being insisted upon. They are then coloured with flat washes, or sectioned over variously with the draw pen; the inscribed and containing figures being tinted with complementary colours. Where parts of circles cover each other, each circle is coloured with a primary, so that the part overlapped becomes of a secondary colour, &c. This system is thoroughly worked out, and thus, at the same time, the student is learning practical geometry, shading with the pen, the use of the brush, and elementary colouring; so that, by the time he reaches the studies of mechanical or architectural construction, he is able to draw and colour with tolerable correctness.

In these studies, too, the shading is scientifically worked out; all the shadows on the sphere are projected in circles, each circle separately tinted, according to its position, and so accurately, that at but a short distance the separate circles are not observable, but a beautiful rotundity of form is the result.

An excellent collection of scientific drawings was exhibited by the Industrial Union of the Grand Duchy of Hesse (Grossherzoglich Hessischer Gewerb-Verein), being the works of the pupils in schools for workmen of the duchy. These sets of works were the more valuable as it was evident that they had not been specially executed for exhibition, but seemed to have been taken from the daily studies of the pupils. They indicated, as indeed did all the works of the continental schools, an absolute connection between the scientific and artistic studies; and all the science students seem to learn free-hand and ornamental drawing and shading, &c., as well as mechanical drawing.

The whole subject of technical drawing, whilst it has been much neglected in this country, has been thoroughly systematized on the Continent; and the foreign schools possess completely organized sets of examples, combining the study of drawing with that of construction, adapted to the various branches of industry, of which we are very deficient. Thus there was exhibited by Wilhelm Beyerle, executed by the Gewerb-Verein, a work in eight parts, quarto imperial, with folding plates, called "Pattern drawing for artizans, adapted for the various trades;" each part containing numerous plates of working drawings, to scale, of the work of the engineer, builder, tin-plate worker, bricklayer and mason, cabinet maker, upholsterer, slater, and staircase builder, in stone, wood, and iron. These plates, which are exceedingly good and are accompanied by complete text, would prove most useful in our science classes. Another set by the same publisher, designed by Hekter Rössler, is called "copies for workmen's schools." It is in seven parts and contains geometrical construction, descriptive geometry, stonework, roofs and joints, stoves and heating apparatus, locksmiths' and cabinet-makers' work.

Still better, because larger and bolder, are the sets of diagrams and examples exhibited by the Royal Commission for parish workmen's schools in Wurtemburg. These are large (royal) lithographs of the most practical character, and all drawn on the scientific principles adapted for almost every branch of construction and ornamental work, with details to a larger scale, and broadly coloured. The work is issued in parts of 48 plates and one sheet of text to each. Works in plaster, metals, and wood, by pupils of forty-four of the parish workmen's schools of Wurtemberg, were exhibited. These consisted of models of machines, buildings, roofs, scientific apparatus, furniture, &c., either to the real size or to a scale, whilst in the art division there were fine drawings from the round, plaster casts of ornament and figure, chased and hammered metal work, carving in wood, &c., all exceedingly good in character, and all showing the results of a sound system of technical education.

From the printed documents it seems that the first step towards the establishment of the series of technical and workmen's schools in Wurtemberg was made in 1818, by the introduction of drawing-classes into Sunday-schools, already established, for youths above fourteen years, who had left the primary schools.

Steps were afterwards taken by the Board of Education for extending the principle, but in 1848, the actual organization of working men's schools, as they are at present, was inaugurated by the then newly created Board of Trade and Industry, which was charged with the care of providing good instruction for youths engaged in trades and workshops. To effect this purpose, a special commission was appointed; but this commission had not the legal power to *order* parishes to establish the schools required, but could only proceed by way of *recommendation* and by treating with such parishes as had shown interest in the subject. They were, however, much aided in their efforts by the circumstance that pecuniary means were liberally granted by the state in the form of subsidies to such schools as had been organized in conformity with the conditions fixed by the commission—the sums granted in this way amounting in general to half the expenditure made by the parishes themselves for the support of the said schools. The conditions chiefly insisted upon by the commission in the organization of the schools were, in the first place, the voluntary principle with respect to the frequenting of the schools; and the demand that fees should be paid by the scholars—a demand which, however small the fee might be, was considered of importance with regard to the well-known fact, that what is paid for is much more appreciated than what is obtained gratuitously.

The principal task of the commission is to take measures that suitable localities are selected, and that all necessary appliances for education, such as good books, models, diagrams, &c., are provided for the schools; to control the appointment of the managing bodies and inspectors, as well as the training up of good teachers of drawing, &c. The commission did not, however, deem it advisable to organize all the schools after a uniform system, but had regard to the various local circumstances and necessities. The 101 schools, numbering about 8,000 scholars, present, therefore, very different phases of development.

The four largest schools in the towns of Heilbronn, Stuttgart, Ulm, and Reutlingen, containing unitedly 2,500 pupils, have Sunday and evening classes offering all the different branches of instruction for mechanics, tradesmen, and young merchants; whilst the drawing-classes may be frequented throughout the day. At Stuttgart and Reutlingen there are also classes for young females who have left the primary schools, and which are attended by 130 scholars.

Thirteen schools established in the towns of Esslingen, Ludwigsburg, Gmund, Hall, Ravensburg, Biberach, Rottenburg, Canstatt, Tübingen, Geislingen, Ellwangen, Calw, and Ebingen, with conjointly 1,600 scholars, have likewise Sunday and evening classes, as well as drawing-classes, open throughout the day, but no mercantile classes. There are, moreover, 60 towns and 12 villages, having together 72 schools, and about 3,500 scholars, with regular classes on Sundays and on the evenings of the week. Of these five schools, numbering together about 250 scholars, have Sunday classes only. Three schools, with about 100 scholars, have Sunday classes combining scientific instruction with drawing; whilst four others, with about 100 scholars, confine themselves entirely to drawing.

In the Swiss department of the Paris Exhibition were several excellent works, illustrating the course of studies in architecture, engineering, and surveying. No novel features were, however, presented, the works being based on, or copied from, the German system; but this serves to prove the efficient and successful working of the Ecole Polytechnique Fédérale.

Years of observation, study, and practical teaching, have shown me that, however good the diagrams and examples used may be, no real conception of forms can be obtained without the aid of solid models; for even though the pupils thoroughly understand the diagram, the form there given is only such as would be correct in *one* position; and in projection, it is in some cases almost impossible from that one view to form an idea of what shape may be presented by the smallest rotation, depression, or elevation of the model. In this, projection differs from perspective, the one rendering the object as it *is*, the other as it *appears;* and here the imagination or observation generally offers some assistance; but in projection it is not so; point by point has to be obtained, which, when united by lines, develop forms which to the student are often surprising; and if the subject has only been worked out on the blackboard, and followed line by line by the students, they get the diagram *copied*, but they have not had the lesson which might have been given by the aid of a block or two of wood or a sheet of cardboard. This is very observable in that branch of mechanical drawing called development of surfaces. For instance, let it be required to teach a class of artisans to construct of sheet iron a pipe with two elbow-joints; these students would most likely have been accustomed to cut, file, and alter the separate pieces of piping so as to get the joints at the angles: and it would be difficult to convince them that the flat metal might at once be cut on properly constructed curves, so that the parts, on being rolled into cylindrical form, would fit each other at the required angles without any waste of metal or time. But if a cardboard model has been prepared and exhibited in the course of the lesson, flat, and when the blackboard-construction has been followed, separated into three pieces and then placed in the required form, the interest of the pupils will not only be kept up, but they will be encouraged to think out similar developments adapted to their respective trades. Again, in the development of a cylinder penetrating a square prism, the forms of the aperture in the prism and the projecting portions of the cylinder are so different from what the uninitiated might suppose, that ocular demonstration becomes necessary, and the scientific construction of the curves may save the workman a great amount of time and labour.

The most complete collection of apparatus for teaching the sciences in connection with the mechanical arts was that exhibited by the Polytechnisches Arbeits Institut und Machinenfabrik in Darmstadt, the author of which is Professor Schröder. The first part of the series consists of models for teaching descriptive geometry, penetrations and sections of solids, and developments of surfaces. These models are placed on wooden planes at right angles to each other, thus realising the vertical and horizontal planes of projection—the plans and elevations being drawn under and at the back of the objects. These models are not new to this country; a set of them was exhibited in London some years ago, and they have now been admirably reproduced by Messrs. A. & J. Rigg, of Chester. The great accuracy of their construction, and their number, renders the set necessarily expensive; but it is to be hoped that some aid or encouragement may at no distant time be given for the production of a selection of these models of a larger size, and in a somewhat simplified form, so that they may become more generally known and used. By the kindness of Mr. J. Rigg I am enabled to exhibit some of these models.

The same Institute also exhibited a set of mechanical combinations and models, designed by Professors Redtenbacher and Weisbach; they are made principally of iron, painted and bright, and are of the average height of eighteen inches; amongst them are the various escapements, shafts for the transmission of motion at various angles, turbines, water-wheels, various systems of spur, cog, annular, crown, face, and bevel wheels; plummer blocks, square, and elliptical wheels and cams, the various modes of coupling and disengaging shafts, Watt's parallelogram and a sectional model of part of a steam engine, showing the interior of the cylinder, valves, the action of the governor, &c. All these are actual working models, and would be invaluable in our science classes, as they comprise actual illustrations of most of the diagrams in Goodeve's and Baker's elements of mechanism.

The Trade Association of the Grand Duchy of Hesse Darmstadt (Grossherzoglich Hessischer Gewerb-Verein), exhibited also a series of eight tables or platforms, for teaching orthographic projection, designed for the use of the workmen's schools of the duchy. These realise the idea I have hinted at; being, for the most part, selections from Schröder's set, but much larger, and better adapted for class teaching. Accompanying these models is a set of diagrams, entitled, "Orthographic Drawing Examples for Workmen's Schools," which are calculated to give great assistance to teacher and student.

I have already referred to the exceedingly useful collection exhibited by the Imperial Ministry of State of Austria. I now return to that group, in order to notice a set of cardboard planes, showing the developments of various solids. They are called Stereometriche Tafeln, by Dr. Hillardt. These planes have the development of various geometrical solids drawn on them, and some of the lines being cut half, and others entirely through, each solid can be, as it were, raised out of the flat surface and restored to its original position. I have imitated a few for exhibition this evening. They are all so simple in construction, that any intelligent teacher can make them, and the pupils will always be glad to discover for themselves the developments of other forms. These planes are not quite original, as some of a similar character appeared in a work by Cowley, published in London in 1787.

In the Belgian department, Gaspard de Munter exhibited an extensive set of models for architectural and constructive science; they consisted of 186 models, in white wood, of the scarfs and joints used in carpentry, 13 models of staircases, arches, niches, &c. Nearly all of them may be taken to pieces, to show the mutual connection of the various parts, and are adapted not only for scientific instruction, but also for models for drawing and shading.

In the department of the Exhibition organized under the auspices of the Minister of Public Instruction of France, was exhibited a system of scientific drawing, which will, no doubt, be admitted to be an improvement even on those by Schröder. This system, designed by Frère Victoris, the professor in the Institut des Frères des Ecoles Chrétiennes in Paris, has deservedly received the gold medal of the Exposition. The whole scheme is fully carried out, there being, firstly, text books for the pupil, and others for the teacher, adapted to each of the two years over which the course extends. 2ndly. Large diagrams, for schools where the class is so numerous that the master cannot spare time to work out the lesson on the black-board. 3rdly. The models, which are still further developed by Frère Victoris, by the addition of a plane at right angles to the other two—this third plane, on which the side or end elevation is projected, moves on hinges; and as the lines are made to work into each other, the paper which covers the planes will, when laid out flat, show how the heights and widths have been obtained from the object. Amongst the models is a niche under a pediment in plaster of Paris, which is cut vertically and horizontally so as to show sections of the niche, cornice, and pedestal, and is a good study for artistic as well as for scientific drawing. The other models comprise several arches and staircases, with movable parts, three large planes with objects, such as capitals of orders, cornices, &c., to be used as studies for the projection of shadows, also numerous roof-timbers, not merely as trusses, but as portions of roofs showing the whole assemblage of timbers. These, if reproduced on a larger scale, would be of the greatest use to our science teachers. The set also comprises columns and entablatures of the orders of architecture made of hard wood; these divide so as to exhibit the entases of the columns and numerous sections of capital, cornice and base, all the parts fitting together in the most exquisite manner. There are also wooden cornices made up of various mouldings, which, being open at the ends, show how the members are made up. The models I have mentioned are but types of the whole system, which is more fully described in the documents before the meeting.

The institution referred to is—firstly, a normal school for training teachers, and has connected with it in various parts of France schools representing 12,000 pupils; secondly, a hospital for decayed members. I had the privilege of visiting the establishment, and Frère Victoris, with the utmost urbanity and liberality, devoted much time to the explanation of the details of the system of teaching, and kindly supplied me with some of the models and text-books which are on the table, together with a report on the whole system.

It is obviously impossible, in the limits of a paper such as this, to describe all the numerous sets of works exhibited by the municipal, communal, and professional schools of France. The exhibits of the professional school of Ivry-sur-Seine, the central school of Lyons, the Paris school of commerce, and the professional school of Vincennes, the municipal school of industrial art at St. Quentin, of the Ecole Speciale de Cluny, of the professional school of Mulhouse, the Ecole Impériale des Arts-et-Métiers at Chalon, and the Ecole Centrale Lyonnaise, &c., can only be cursorily mentioned, in order to show the universality of technical teaching throughout the length and breadth of France. I am, however, prepared with notes of the works exhibited by most of these schools, and which can be referred to when required.

Leaving the geometrical, mechanical, and architectural branches of scientific instruction, I now proceed to give a brief account of some of the collections of models and subjects for teaching animal and vegetable physiology which were shown in the Paris Exhibition; and foremost amongst these rank the "clastic" anatomical models by Dr. Auzoux. The author explains in his catalogue that he derives his term clastic from the Greek word *κλάω*, to break—as each of his models is composed of several pieces, which can be separated, as in a real dissection, and can be again replaced.

Thus, there is a complete model of the human body, size of life, composed of 130 parts, all of which may be detached, exhibiting upwards of 1,700 objects, comprising the leading features of the muscular, arterial, and nervous, systems—the heart, lungs, viscera, brain, &c. (£120). The eye, greatly enlarged, with part of the orbit, the muscles, vessels, nerves, membranes, vitreous humour, crystalline lens, &c. (£3). A large model for teaching physiology in colleges and other establishments, where general notions only of natural history are required, representing on one side the muscles and vessels of the superficial layer, and on the other the muscles, vessels, and nerves of the inner layer, &c., &c. The price of this model is £40; its size, 5ft. 9in. A horse, size of life, separable into 200 pieces, comprising more than 3,000 minutiæ (£160). The boa constrictor, 7ft. in length, with its complete anatomy (£12). The silkworm, 2ft. 6in. in length, showing the alimentary canal, muscles, nerves, trachea, and the apparatus for the formation of the silk (£10). Bees, magnified to about 3in. in length, showing the four varieties—queen, male, honey, and wax bees—the honey-cells, the development of the larvæ, &c. (£8). Also, a collection of models, exhibiting the principal functions of mammals, birds, reptiles, fishes, mollusca, insecta, and radiata (£40). Dr. Auzoux also exhibited very large models of plants, showing the seed, flower, and fruit, separable into numerous parts, with the most minute portions of vegetable organisation in the various stages of development. The whole collection, the descriptive catalogues of which are on the table, is one of infinite interest, beauty, and instruction; whilst the size of the models is such as to enable a lecturer to show even the smallest organ to a class; but the prices would, it is feared, militate against their general adoption. A number of them might, however, be purchased by a central institution, and circulated amongst science schools, under the system by which pictures, books, &c., are now lent to schools of art by the Science and Art department. It is impossible to understand clearly the action of any machine without a knowledge of its construction, and, as the animal and vegetable structures are far more complex, and contain more minute parts, each having its especial function, physiology cannot be thoroughly taught without taking the pupils through a course of constructive anatomy. The use of these models thus becomes evident, as they are second only to absolute dissection, which is neither practicable nor desirable in classes or schools.

A few more elementary subjects might perhaps be added with advantage to the set, such as longitudinal and cross sections of bones, showing how they are nourished by means of the vessels in the Haversian canals; a joint, showing the mode of lubrication by the synovial burser; sections of the skin with perspiratory glands, exhibiting the ill-effects of allowing the pores to become stopped up.

Another exceedingly useful set of models for teaching botany was exhibited by Mr. Robert Brendel, of Breslau. They consist of buds, flowers, fruit, &c., made of thin metal, coloured to nature, and mounted on stands, and arranged both according to the Linnæan and natural classification. Amongst the models in the first series are plants exemplifying the difference between *Monocotyledons* and *Dicotyledons*, &c. The second series shows the germination and development of various leading families of plants; and in a set which Mr. Brendel mentions as being in preparation, we are promised models of the leading plants used in trade, which will materially aid the lecturer in the important subject of economic botany.

Mr. Fric, naturalist, of Prague, exhibited a series of collections for teaching natural history on an extended scale. Amongst these subjects are animals preserved in spirit, such as the squirrel, mussel, &c., the animal being laid open, so as to show the entire internal construction.

Mr. Fric has also produced a set of 100 models, in plaster, of *Foramenifera* and *Polycystina*; these are all about five or six inches high; which would prove very useful in class-teaching, being absolute realizations of microscopic observation of these minute organisms.

The series also comprises models of *Radiata*, partly cut away, to show their structure:—a collection of 30 corals mounted on stands; a set of 63 specimens of *Actinia*, in coloured glass, mounted and classified, and also numerous collections of fossils and minerals, skeletons, shells, insects, &c. Catalogues of this and Mr. Brendel's collection are on the table.

Of all the polytechnic schools the systems of which I have had under consideration, the Royal Polytechnic School at Hanover seems the most comprehensive in its working, and I therefore select it as a type. The detailed prospectus, with arrangement of hours of study, fees, &c., is on the table; and it is only necessary for me to give a rough outline of the system pursued. The institution is divided into the lower and higher school. The subjects taught in the lower school are mathematics, zoology, and botany, the instruction in both these subjects being arranged with especial reference to the animal and vegetable products used in trade; mineralogy and freehand and linear drawing. The course in the upper school embraces higher mathematics, descriptive geometry, theoretical and applied mechanics, architecture, theoretical, constructive, and historical, in relation to private and public buildings, bridges, railways, and waterworks; geognosy, geology, practical and technical chemistry and analysis, mechanical technology, including works in metal, wood, weaving, modelling, ornament and figure, and the construction of architectural and mechanical models.

These studies are divided into courses for chemists, land-surveyors and proprietors, civil and mechanical engineers, architects, &c., &c.

From the prospectus of the Polytechnic School it will be seen that special text-books, adapted for each course of study, are used, and this leads me to mention the great scarcity not only of authorised text-books, but of books of questions in relation to the now known laws of physical science. On this subject the Rev. Arthur Rigg, Principal of the Training College and Scientific School at Chester, writes:—" No technical instruction can be valued as it ought to be, unless the laws of the technicality are not only known, but can be readily and confidently applied as we do our own weights and measures. To attempt otherwise seems much like undertaking to calculate 'exchanges' without a knowledge of the relative values of the monies involved, or like selling by weight without the ability to convert one weight into another. Our difficulties in this respect have been immense; indeed, we have been driven to print sheets of questions which serve, as it were, for a technical arithmetic, and which are worked as exercises. In practical engineering and chemistry, text-books and questions are to be met with; these remarks therefore apply more especially to heat and voltaic electricity; others might be named, but these have been most required here."

Mr. Rigg has kindly sent me specimens of the papers, and they are laid on the table.

As before stated, the remarks in this paper must be confined principally to the series of studies comprehended under the head of Scientific Drawing, which study pervades more or less the entire curriculum of technical education on the Continent. All the other branches of study seem, however, to be taught with equal exhaustiveness, and the excellent mechanical works exhibited prove that efficient workshops exist in numerous schools. How the various studies are made each to subserve the other, how the workshops are conducted, and how the laboratories are carried on, will be reserved for future investigation, when the whole question of the establishment of technical schools in England shall be practically considered. And I venture to express the opinion, that before we can benefit by the results of the continental schools, they must be visited, not by diplomatic agents only, but by practical educationists and teachers of the various subjects, so that the systems may be seen in actual operation, and that a plan, adapted to the wants of this country, may be devised by a conference, which I am glad to hear has been organised by the Council of this society, in which the leading professional teachers, engineers, architects, and manufacturers will, I presume, be invited to take part. The inauguration of such a movement as this comes especially within the sphere of the Society of Arts, to which this country already owes so much, and which has for more than a century been actively engaged in the promotion, not only of arts, manufactures, and commerce, but of every scheme tending to the physical, social, and moral well-being of the people, and which, recognising the great fact that education must be the foundation of all progress, has for many years organised examinations throughout the country, thus proving its ability and its desire to carry out any great measure which shall tend to the improvement of the human family.

After careful study of the complete sets of scientific drawings exhibited by the numerous continental schools, and from other data, I have come to the conclusion that the following is the basis of the system pursued; the studies being in some instances divided into two, and in others into three courses. I have thought it best to adopt three, prefacing that each of the heads I give are divisible into numerous branches at the discretion of the teacher, and according to the requirements of the locality.

1st Course:—Practical plane geometry, elementary freehand drawing, flat tinting with pen and brush, elementary colouring, solid geometry, perspective, model drawing, and projection of rectangular objects to a given scale.

2nd Course:—Advanced practical geometry—embracing the higher curves and figures used in machinery and architecture—such as the conic sections, the cycloid, the epicycloid, the helix, conchoid, cissoid, spiral, &c. Orthographic and geometrical projection, penetrations and sections of solids, development of surfaces, and the projection of shadows, advanced perspective, freehand, and model drawing and shading.

3rd Course:—Machine drawing—including the construction of the teeth of wheels, screws, &c., from blackboard lessons; rough sketches, and actual measurement to scale and given data; tinting and broad shading. Building construction, practical and historic architecture, ornamental and architectural drawing. Construction of technical working-drawings to scale, adapted for the various branches of industry.

Turning now from continental schools to the consideration of some plan for the promotion of technical and scientific education in England, the necessity of training efficient teachers at once becomes apparent. I venture, therefore, to suggest a plan which will, in my opinion, not only meet this requirement, but which can be brought into action without any delay, and at a comparatively small outlay. There are now in operation about twenty-four training colleges, in which masters for National and British Schools are educated; and these buildings, which are not all, I believe, as fully occupied now as they were formerly, might, with but little reorganization, be converted into centres of industrial, as they are already of general, instruction, viz:—by adding to them good laboratories and workshops, such as have, for many years past, been in operation in the Chester Training College. The laboratory should be under the charge of a thoroughly practical chemist, and the workshops superintended by skilled workmen, who should teach the students to carry out the design, plan, or mechanical construction, the scientific principles of which they have been taught in the class-rooms, and of which they present working drawings made under the superintendence of the drawing professor. Each student in training should, during his first year's residence, pass a certain time in each of the workshops, in order to acquire a general insight into the various practical arts, and might, in his second year, select a speciality. Third year free studentships might be awarded, to allow of higher cultivation, in order to enable the students, on leaving the training college, to carry on, in the national schools of which they may subsequently become masters, a preparatory system of scientific and technical instruction, which would be developed according to the resources at their command. These classes, consisting of the senior boys, would have the effect,—firstly, of inducing the parents to allow their sons to remain longer at school; secondly, of enabling the boys to obtain such a fundamental and practical knowledge of various branches of industry, that they would, at once, on being apprenticed, be found too useful to be put to drudgery, but would enter on their term with interest, prepared to learn the higher branches of their trade; thirdly, the boys, having been taught to think of work as something higher than mere manual labour, would become elevated mentally and morally, with benefit to themselves and to society at large.

The great difficulty I anticipate is the arrangement of time; and this point is far too scholastic to come within the range of this paper, involving, as it does, the balancing of the relative importance of each study, in order to the curtailment of some, and possibly the entire omission of others. Such discussions would at this moment be premature, and will no doubt be satisfactorily settled when the whole grand principle shall have been agreed upon.

In addition to this proposed increased sphere of action of the training colleges, there might be established in London a central technical college — an absolutely polytechnic school, such as those of Hanover and Darmstadt, &c., to which students should be admitted on payment of fees, graduated according to their position in life, and to which each training college might have presentations for scholarships.

Appended to each college for the preparation of teachers might be a school for youths of a higher class, in which science should be taught theoretically and practically, and that, too, not in the elementary form sometimes called science-teaching, but even to those branches which involve the application of mathematical formulæ; as, for example, the processes of chemistry and its allied sciences, heat, light, electricity, magnetism, &c. Of course engineering, and the sciences in connection with it, necessitate mathematical knowledge, and there are many reasons why this, which gives solidity to the practice of engineering, should not be so much disregarded as it usually is in equally important departments.

At such a school, the pupils would, as a rule, remain much longer than the students previously referred to, consequently their technical instruction might be more fully carried out, whilst the fees paid by them would contribute to the maintenance of the establishment.

Having been for nearly fifteen years associated with a school arranged upon this plan, I venture, with some confidence, to quote it as a type. Connected with the Training College at Chester is a scientific and technical school, which is provided with a large laboratory, supplied with every requirement in the shape of apparatus, chemicals, &c.; and instruction (mathematical, theoretical, and practical) is daily given in it. There is also a mechanism department, in which are many of the various component parts of machinery, arranged so that the shafts, wheels, &c., fit the respective pieces; thus machines may be built up from given data, and motion of one kind changed into motion of another. There are workshops with lathes, forge, &c., in which the boys work whenever their studies permit. Practical instruction is given in trigonometrical land surveying; and the apparatus for instruction in the principles of acoustics, light, heat, magnetism, electricity, is very extensive, and in daily use.

Papers in relation to this school are on the table, and I am quite sure that the principal, the Rev. Arthur Rigg, would give to any one interested in technical education the results of his long experience. Believing that to those present, whatever relates to industrial education would be of interest, I have obtained some printed copies of a letter which appeared in a local paper in 1850, giving a clear insight into the technical character of the instruction in the school I refer to seventeen years ago. The progress of science has now, in some measure, altered what is there described; but whilst the subject on which the teaching power is exerted may, from time to time, change, the spirit and purport of the whole working confirm the views put forth in this paper.

Whatever has been said of the unpractical character of most of our schools for boys, refers equally to those for girls; and when the whole question is taken into consideration, there is no doubt that the plan I have proposed might, in a modified form, be extended to the 21 colleges for the training of schoolmistresses, so that the future teachers of the female children of the working classes might be taught domestic economy, the physiology and chemistry of common life, cooking on scientific principles, general household management, making and mending, together with nursing the sick, and the elements of domestic medicine. In all these subjects the education of most of the young women of our age is very defective, and if it be desired to elevate the men of the future generation, we must efficiently educate those who, as wives and mothers, will exercise over them an influence which it is impossible to over-rate.

I would further propose the establishment of evening technical classes, with which should be connected workshops and laboratories for artisans, adapted to different industries, and supplementary to the science classes. Each of these should be under the superintendence of thoroughly skilled teachers, who should practically demonstrate the principles of construction.

Each artisan should be allowed to work out his own inventions, or try experiments under the guidance of the superintendent, which would, I believe, tend to encourage invention, for it must be remembered that in the present state of things a workman, even if he were to invent any machine, or make any discovery, has neither time nor opportunity at "the shop" to carry out his ideas, and, not possessing laboratory, forge, lathe, or bench, he is prevented working at home.

These national workshops should be aided by Government grants towards the salaries of the superintendents and the purchase of examples.

Associated with these technical classes should be museums—such as the Economic and Sanitary Museum at Twickenham, established and supported by the munificence of a gentleman, long and deservedly well known for his enlightened views and his devotion to the promotion of the well-being of his fellow-creatures—a vice-president of the Society of Arts, Mr. Thomas Twining. To describe this unique museum would occupy more than one complete evening; but a number of copies of the synopsis of the chief classes of the objects illustrated is on the table. To read this synopsis is in itself a lesson —not only on technical education as applied to trade, but to the alleviation of "all the ills that flesh is heir to." This museum has a library of works having reference to the subject.

Mr. Twining, too, has written a series of familiar lectures on the application of science to the requirements of daily life, which Mr. Freeman, the curator of his museum, aided by Mr. Whipple, of the Royal Kew Observatory, is delivering in the neighbourhood of London; and, such is the appreciation of these lectures, that Mr. Freeman informs me that he has engagements to deliver them twice a week until next March, the complete apparatus and diagrams being provided at the expense of Mr. Twining.

The whole of the plan I have thus roughly sketched might, I think, be efficiently carried out by the Committee of Council on Education, by adding to the Department of Science and Art a technical and industrial branch, in the conduct of which men eminent in science, engineering, architecture, chemistry, and manufactures, should be associated as a board. The Department of Science and Art has already accomplished good results in bringing about a healthy system of art education, has promoted the establishment of science classes, and founded one of the finest museums in the world. The already existing machinery could, with but small additions, become competent to inaugurate and supervise trade-schools, which the comparison of our educational system with those of many continental nations. and the opinion of some of our leading men, declare to be necessary for the welfare and progress of this country.

I have dwelt specially on the subjects of architecture and engineering, but I wish it to be understood that I include *all* practical arts that require technical knowledge, including the entire range of manufactures, and this will perhaps explain why I have said that science and art should be closely combined, so that we may have scientific construction artistically ornamented. The manufacturers of this country have ever been foremost in the march of civilisation and enlightenment, and I am convinced that they will unanimously support any movement tending to the mental elevation of their employés. Thus this great country, universally quoted for its munificence and for its liberality of sentiment, will, by the united efforts of her people, be able to hold her own against the world; and thus also will those who work, whether at the forge or at the bench, at the loom or in the laboratory, be thought of, not only as so many *hands* but as so many *brains*—as beings into whose nostrils an omnipotent Creator has breathed the breath of life; and as He has never said to the sea of human intellect "thus far shalt thou go and no further;" as His light penetrates the pitman's hovel as brightly as the nobleman's mansion, it will be felt to be the duty of the State, and all under its sway, to develope to the utmost the minds of the people, to the glory of His name and the honour of our native land.

DISCUSSION.

Dr. **Hyde Clarke** said they were much indebted to Mr. Davidson for bringing this subject before them, more particularly as he had a practical acquaintance with teaching in science and training schools; but while the subject was one of great importance, they ought not to exaggerate this on the one hand, or underrate it on the other. Although they had the authority of Dr. Lyon Playfair in this matter, he thought there was a tendency, on the part of professors of education more particularly, to underrate the position of English manufacturers as compared with those of the Continent. With regard to the period at which we began to observe our deficiencies and apply the remedy, he understood Mr. Davidson to look back more particularly to the Exhibition of 1851. He (Dr. Hyde Clarke), however, remembered being on a Committee on this very subject no less than thirty years ago, which was under the auspices of the present Lord Taunton, of which Mr. Ewart and himself, he believed, were almost the only other surviving members. He recollected, at the period he referred to, there was laid before Parliament and before the public precisely the same kind of information as they had had from the author of the paper this evening; and they succeeded on that occasion in obtaining a general promise from the Government that a remedy should be applied. The state of technical education on the Continent at that time was fully ascertained, and our own deficiency in that respect pointed out. That committee succeeded in getting the schools of design put into operation; and fully assured that the rest of technical education would follow in the same course, they gave up the agitation. The result, however, had shown that they were too sanguine, and ought not to have ceased in their efforts. Feeling, as he did, a strong personal interest in the subject, it was a gratification to find that the Council of this Society had proposed to call together a conference to discuss the question, and he trusted they would not cease from agitation till the whole object had been accomplished. Let them profit by the experience of the past, for the moment they ceased to agitate, notwithstanding the promises of any Government, there was danger of the subject sleeping, as on the former occasion he had referred to. He left it to others to determine what the particular mode of action should be. The choice of a man's special trade in most countries was left almost entirely to chance. It was only under unusual circumstances that the trade of a boy was fixed from the moment of his birth by the particular position of his father, therefore practically they had to ascertain what was the sort of instruction they would give him that would be of use to him in future life, whatever employment he might adopt. They had the experience of the excellence of the continental system of education; but there came the practical question—was it the fact that the workmen turned out from the continental schools so absolutely carried the day against us? He was satisfied that was not the case. There were other things besides instruction in chemistry, mechanics, or drawing, which were essential for the manufacturer and for the workman. It had been well said by the author of the paper that the manufacturers of England had never been deficient in intelligence, enterprise, and public spirit; and he was sure, under these circumstances, the difficulty they had to meet was far less than had been on many hands represented; but that could only be adequately met by practical remedies; and we must be cautious not to over-school our people, and not to go to too great expense to establish schools or professorships which might be agreeable to those who held the appointments, but would not result in practical good to the community at large.

Mr. **George White** said he endorsed a considerable number of the sentiments expressed by the gentleman who had just spoken. During the last thirty years he had had opportunities of seeing what the real state of the education of the workmen of this country was. It seemed to him the paper was devoted rather to the practical details of how teaching should be carried on in these technical subjects, than to what chiefly concerned us at present—namely, the means we should use, and on what principles we should use those means, so that technical and industrial instruction might be made more general in the country. He remembered, as far back as 1839, going into a school, and seeing the master teaching the boys from a bunch of turnips; in another school seeing him cut washing-tubs in half to show the section; in a third he had seen the scholars drawing from the chairs and forms, and other matters simple and ready to hand, without an elaborate apparatus. He considered that there was work to be done by these simple means. Some twenty years ago he put himself under the instruction of Butler Williams, who taught under the auspices of the government, and had a very fine series of models, and he put himself through a course somewhat more practical than was taught in the ordinary schools. They were indebted for the introduction of those models and apparatus to Sir James Kay Shuttleworth, to whom also they owed much of the progress of education generally. He thought the system of teaching, and the apparatus employed, could not be too simple. Some years ago he attended a course of lectures by Dr. Reid, but he was probably more taken with the illustrative and experimental apparatus than with the great principles themselves which were taught in the lectures. He had been at a school held in a cellar in Regent-street, in which the lecturer began his address with a blacking-bottle, which appeared to be more successful than spending a great deal of money in fine apparatus and instruments. The author of the paper had hit upon the real difficulty, viz., what portion of the time were they to steal from the ordinary school instruction, when children left school for the most part at twelve years of age? And whether under such circumstances it was possible to teach them science and the arts? Was it possible to do so at this early age? Was not the clay too soft to retain the impression? He dissented from the view that the training colleges should be converted into science schools, not because he did not approve of technical instruction, but he was fearful lest anything should be taken from the instrumentality for general education, which was at present not sufficient for the country. Another point was the industrial training of the apprentice class of youth. He was in favour of apprentice schools apart from the primary schools. Mr. White then referred to the degradation of Mechanics' Institutes, in most cases, throughout the country, from the objects for which they were originally established into places of mere amusement, and expressed an opinion that the action of the Society might be brought to bear beneficially in endeavouring to bring back those Institutions to the legitimate objects for which they were intended. He was favourable to what might be called technical teaching in such Institutions, and said he was convinced, from his own practical experience, that lectures illustrative of various branches of manufactures would be well attended.

Mr. Thomas Webster, Q.C., agreed very much with many of the observations of the last speaker, because he could not but conceive that the hope of educating the people, by making lectures entertaining and merely recreative, was not a sound principle to go upon. He did not believe that a greater subject, or a more important one, could occupy the attention of this Society than the industrial and scientific education of the people. But what did we mean by that? He thought we meant what was so well expressed in the last paragraph of the paper—that we had to deal with brains rather than with hands—that was to say, we were to afford to those whom Providence had endowed with a capacity beyond the mere exercise of handicraft, the means of exercising their talents to the best advantage; and he believed we should be wrong if we did not limit their education to a very few subjects. We were not now dealing with the education of the masses in the ordinary elements of knowledge, but with a class intended to receive something in the nature of scientific instruction. He thought we were in danger of losing ourselves in too great diffusion. If we were beginning to teach the subject of mathematics, and if we found there were pupils amongst the number who were unable to pass from geometry of two dimensions to geometry of three, or, in other words, solid geometry—if they did not know the difference between a plan and a section—which many did not—we might reject such men as incompetent to advance towards mathematical knowledge. That was one test which appeared to him valuable for dividing men into two classes; but he did not mean to say that a man who could not deal with any particular class of knowledge, such as he had just referred to, would necessarily fail in other branches. There were some who might excel in chemistry, natural science, and physiology, who, nevertheless, had no capacity to deal with geometry of three dimensions. In the matter of education we were in danger of running wild, and trying to teach too much. Though he did not sanction the appropriation of Mechanics' and kindred Institutions to merely recreative purposes, though he would refer with gratification to what Birkbeck and Brougham did forty years ago in regard to popular education—yet, dealing as we did with the education of the people, we should endeavour to lay down what were the elements of education really essential for them. We should not attempt too much, being assured that if we had them well grounded in first principles, they would afterwards diverge into the particular departments of knowledge for which their several tastes and capacities adapted them. He thought the difficulty of the day was that we were in danger of being too diffuse in education, and of attempting too much.

Mr. Hartley remarked that technical education, on the system suggested in the paper, was useful to those who had funds to pay for it; but that which was more important was the education to be afforded to the working-classes. He regarded the apprenticeship system which formerly obtained in this country as the chief means of industrial training of the operative classes; and for the last twenty-five years he had taken advantage of every opportunity afforded him to advocate a return to that system, from a conviction that it was the most beneficial one that could be adopted by the employers of skilled labour, and he hoped the Society would take up the subject.

Mr. Jones thought there was no necessity to resort to legislation on the matter of affording a better practical education to the working-classes, inasmuch as, especially in the City of London, there already existed an organisation adequate to the purpose, if it were properly worked out. There was there an aggregation of chartered companies to take care of the interests of seventy or eighty different trades; and he apprehended it was one of the functions of these guilds to see that the apprentices to the trades were properly grounded in those forms of education which pertained to the business or manufacture in which they were engaged. He considered those functions could be as well exercised at the present time as when the guilds were first called into existence; but their original purpose had been completely lost sight of of late years: and it might be that this defect was not felt until the competition which came upon us from the educated artisans of the Continent, set us thinking what should be done to enable us to hold our position in the race of arts and manufactures throughout the world. In his own company, that of clockmakers, he would state that, so far as the funds admitted, they had done their best to stimulate education in their own branch by giving apprentice prizes for which there had been considerable competition. In this same trade there was also an apprentice school, or Institute, in which technical instruction was given, and it was attended by youths who came as far as from Deptford to spend an hour there after their day's work. He thought in other trades schools for intermediate pupils might be opened, in which competent men, practically engaged in the trade, might bring before the minds of the apprentices as much of the science of their avocation as was necessary for the thorough understanding of the work they were daily engaged in.

Mr. Fazakerley submitted that the progress of this country, in artistic and mechanical skill, as well as in inventiveness, could not be judged of by the results of the recent Paris Exhibition, in which the great proportion of space was monopolised by the French exhibitors. The result of a great deal of practical experience on his part, in teaching in villages, was to show that the plan of education proposed by the author of the paper—while it might be applicable to towns—would not reach the wants of the thinly-populated rural districts.

The Rev. William Rogers said, with regard to what had been said on this subject, it appeared to him to be a question of time. Those who had had experience in schools knew how completely the time was already occupied with necessary subjects. It was, as Mr. Lowe had recently called it, a "ponderation" system. What were the most useful subjects for the children to learn in the time at their disposal. He agreed with Mr. Davidson, that if we introduced a system of technical teaching, which, while it exercised the brains, might, at the same time, exercise the hands, children would be more interested in these subjects of a practical nature than they were in the dry details of English history, for instance, as usually taught in the primary schools, always commencing with those traditionary individuals "the Picts and Scots," in which the children could not be supposed to take very great interest. He thought it was a matter which this Society might take up, to suggest what would be the most interesting subjects of a practical nature to be taught in the primary schools in the event of the plan now brought forward being to any extent adopted. He thought they could not look for any very great amount of co-operation in this movement from the guilds or City companies of London as at present constituted.

Mr. Atkins regarded this subject as one of the most vital of the age, so much so, that some years ago he expended a large sum of money in endeavouring to establish a system for the more extended application of industrial education throughout the country. He was quite convinced, that in mechanical engineering and other branches of manufacture, the education of the artizan must be very different in the next ten years to what it had been in the last. He believed England had now arrived at a position in which the establishment of an extended system of industrial and scientific education, would form an excellent investment for capital.

The Chairman said that before asking the meeting to thank Mr. Davidson for his valuable paper, he would make one or two remarks upon it. The first paragraph, which seemed to be the text of the whole paper, alluded to a statement of Dr. Lyon Playfair, that "with very few exceptions, a singular accordance of opinion prevailed that our country had shown but little inventiveness, and made but little progress in the peaceful arts of industry, since 1862." He begged to say he entirely took exception to the tone and meaning of that paragraph. In the first place he did not admit it was in the power of any man to say that a country like England did not take its proper place in inventive arts and in manufactures, judging merely from its progress in five years, especially when that judgment was formed upon an exhibition in a foreign country at which it was notorious that many of the most eminent of our manufacturers in various branches had not exhibited. Whether our manufacturers were right or wrong in not exhibiting, it was not for him to say. They looked to their own interests and objects; but when a gentleman in Dr. Lyon Playfair's position, writing with the authority of an official person, declared this country had shown little or no progress, he thought it was casting an unfair stigma on the inventive genius and talent of this country. Dr. Playfair hardly ventured to say that we had not made a rapid stride since 1851, because in the interval between 1851 and 1862 we astonished foreigners—the French in particular—by the progress we made, not only in our manufactures, but in our artistic taste. So great was that advance, that the French Government appointed a commission to visit this country to inquire into the means by which that progress had been attained. Therefore Dr. Playfair limited his observation to a period so short, that it was hardly possible to form a correct judgment one way or the other. Let them look at the facts. His friend, Dr. Hyde Clarke, had said that there was a tendency in the present day to exaggeration on this subject. We were treating the matter as though every workman must necessarily be educated in every branch of science, but we overlooked the fact that the large manufactories of this country were, for the most part, under the immediate superintendence of men of high scientific attainments in their respective branches, who directed those under them, and he thought the effect of that superintendence of the master mind was more beneficial to the advancement of those industries than if each of the workmen themselves had dabbled a little in the sciences bearing upon the manufacture in which they were engaged. He did not undervalue the importance of giving the most intelligent of the workmen a practical or technical education; but to suppose we could teach boys in Government workshops, supported by government grants, and superintended by government officers—to suppose that in such shops we should instil into boys that ability for hard work which they could only acquire as apprentices, was, he thought, a fallacy. To make good workmen, they must do it step by step in the workshop, and we must not look to government funds for the purpose. He thought that one distinction between the English workman and his brethren on the Continent was that the foreign workman was always seeking for pleasure rather than work, whereas the English artisan took pride and pleasure in his work. Reference had been made by one speaker to his connection with one of the great guilds of the City of London. He (the Chairman) belonged to a company which had large educational funds, and up to this time he confessed they had not been so efficiently administered as he could have desired; but he hoped the time was coming when this state of things would be changed. The corporation he referred to were endeavouring to establish a school on a scale commensurate to the funds they had in hand, in which he hoped there would be introduced, in addition to the ordinary branches of education, a certain amount of technical instruction. With regard to the opportunity afforded to workmen to obtain a knowledge of the state of their particular trades on the Continent, the Society of Arts, as they were aware, had sent a number of workmen to Paris, to report upon the Exhibition, and their reports were now in the press. So successful had this movement been, that the council proposed in future years to send workmen to other seats of industry abroad, so as to bring them into contact with foreign workmen, to give them additional opportunities to ascertain in what particular points they excelled. Moreover, he believed this would conduce more than anything else to show to the more intelligent of the working classes that trades' unions, as a means of raising wages and coercing employers, would ultimately tend to their ruin by driving the trade away from the country. If free-labour could now be thoroughly established, he believed that, notwithstanding all the temporary disadvantages of the want of schools of art and industry, English perseverance would overcome all difficulties which stood in their way. The alleged more rapid advances of foreign manufacturers arose from their having started from a lower standard, and from their having the best English works to copy. Still he was prepared to maintain that in the manufacture of machinery, England still stood pre-eminent. Our work was still superior, and was done with a finer finish and much greater accuracy; and though the foreign work might perhaps be good enough for present purposes, there was no doubt which machine would be the best after ten years' wear. He did not, however, in these remarks, mean in any degree to depreciate the importance of technical education, but merely to point out that the despairing tone taken by some writers and speakers, as to the decadence of some of our manufacturing industries, was really not warranted by facts. If England was still to maintain her position, she must not neglect to give her artisans the same facilities for acquiring knowledge and improving their taste that were enjoyed by their foreign brethren. He was sure the meeting would accord its best thanks to Mr. Davidson for the very interesting paper he had read.

The vote of thanks having been passed,

Mr. Davidson, in acknowledging the compliment, said he was very much relieved in his task of replying to the observations made, by the circumstance that so few of the arguments brought forward had been absolutely directed to the question of technical schools, for he regarded mechanics' and literary institutions as beside the question. He would, therefore, in the first place, address himself to the observations which had just fallen from the chairman, which he regarded as the most important that had been made that evening. They were directed more against Dr. Lyon Playfair than against himself, and he was not there as that gentleman's advocate, nor to back up all he had said; but he thought they would admit we were not doing all we should in regard to technical education in this country. Any other text would have suited his purpose equally well, such as — "What is the best way of promoting elementary technical education in this country?" and he might then have escaped the criticism of the chairman. But when we found that large numbers of locomotives were sent to this country from Belgium, and that so many of the large engineering works in this country were glad to get workmen from Hanover, Carlsruhe, and other places in Germany, he said it was manifestly wrong that foreigners should take away the work which the English population ought to do. The chairman seemed to misunderstand what he had said about workshops. He never said that Government workshops should be provided for boys, but that they should be open to workmen in order to afford them facilities for carrying out any new idea they conceived, and which they had no means of doing, from the want of proper appliances at their own homes. One gentleman had remarked that the City companies had ceased to be educating bodies. He (Mr. Davidson) would be glad to know upon whom it was to devolve to convert those corporations to their original purposes. He thought we should rather look to a public movement on this subject, considering that the guilds were never intended to educate the members of the trades, but rather to promote the interests of the trades. Some of them, however, did not entirely neglect the question of education. There was a school belonging to the Haberdashers' Company (with which he believed the chairman was connected); and though for fifteen years he had been in the habit of teaching in and visiting schools, he never in his experience met with one where there was a better system of instruction. The school he alluded to was the Aldersey Grammar School, at Bunbury. With regard to what had fallen from Mr. White, he thought that gentleman was fortunate in meeting with good teachers, who could instruct a class with imperfect appliances. It was said that a good workman could work with indifferent tools, but he would work better with good tools; and he thought that adage applied to proper educational appliances being provided, as great aids to practical education. They were not dealing with a measure for the City of London alone, but they were addressing themselves to the wants of a whole nation—to our vast Indian empire, and our colonial possessions. Nearly the whole world was looking to England in these matters, and it was our duty, not to follow Germany or France, but to take our own educational standard; and we should strive to be as much quoted for our educational as we were for our monetary and commercial position.

Mr. George Wallis writes:—As I rose at so late a period of the discussion on Mr. Davidson's very suggestive paper, and was unwilling to delay the chairman in his admirable closing remarks, perhaps I may be permitted to allude to a few points bearing upon the subject of technical education as applied to manufactures, as the subject is rather an old one with myself. Like all new ideas or inventions, this question has its three stages:—1. It cannot be done. 2. If it can be done, *cui bono*? 3. There is "something in it:" And 4. Nobody ever doubted that it was the "right sort of thing" to do. We have at last arrived at the "something in it" stage, and the question immediately at issue is "what to do?" I have no doubt that in 1847, after five years' experience of the Spitalfields and Manchester schools of design, as head-master, I should have been equally confident in a system of education such as Mr. Davidson has sketched out as he is now; but twenty years' subsequent experience in Birmingham and London, and rather exceptional opportunities of judging of the value of mere systems, has led me to look rather to the special circumstances of individual cases or nations. It must never be forgotten that the English manufacturing system was established long before any attempt was made to bring special education to bear upon it by the establishment of Schools of Design, or Schools of Art, as they are now more properly called; whilst, on the Continent, the special teaching applicable to industry grew up side by side with it. The silk trade of Lyons grew up and flourished so as practically to defy all competition, because its great technical school was established and grew with it, and each acted and reacted upon the other over a period of some 150 years. Again, the bronze trade of France, which has developed so enormously since 1844, at which period I visited nearly every bronze foundry then existing in Paris, has rather grown out of the art schools of that city than from those latter being engrafted upon a manufacture already established, with its traditions, rules of thumb, and the noted ignorance of unscientific and inartistic foremen and managers. When the Germans took up this question of developing manufactures after the great war (about 1818), they had the advantage of being able to engraft on their systems of national education those polytechnic schools which have done so much for the subsequently developed industries; and their systems of manufacture grew rather out of their system of education than, as with us, where our system of education, such as it is, has always been hampered by our industrial operations. I know it is always as disagreeable, as it is contrary to "true British" taste, to quote the United States in these matters; but the only conclusion at which my friend Mr. Whitworth and myself could arrive in 1853, after examining the machine shops, and manufactories in that country, and reporting to Parliament thereon, was, that the education of the artisan being carried so much beyond the point of "the Picts and Scots,"—so graphically quoted by the Rev. Mr. Rogers—as well as in other directions, the growth of intellectual managers and foremen became a matter of course, for these men brought their elementary knowledge of science to bear upon their trades, developing and increasing their knowledge by its practical application in the ingenious inventions and improved technicalities of their respective industries. Now, all this is not said in opposition to direct technical instruction in schools or colleges; on the contrary, no one desires to see this matter gone into earnestly and intelligently more than myself; but I desire to see the question considered from an English stand-point, and the facts borne in mind that we have to supplement our industrial with scientific and technical training, and not begin *de novo*. The question still remains to be settled how far our manufacturers will avail themselves of the services of well-trained youths when they are trained. In a former discussion (in 1856) on an analogous subject, I quoted instances of the opposition of managers and foremen—even manufacturers, to the proper employment and encouragement of students from our Schools of Art. I have seen no reason to think that matters are greatly changed, especially in regard to science. Doubtlessly this must and will be overcome; but let us look the real difficulty in the face. I had intended to have illustrated to the audience last night, had time permitted, the action of a certain "Ecole des Tissues" near a frontier German city, in which youths and young men from all nations, and even English, are to be found learning the technicalities of weaving; as also how our German friends utilise certain manufactories at Manchester as technical schools for these young men; whilst no English youth, except those employed on the premises, ever avails himself of them; but this must be now reserved for another opportunity. As regards the late Exhibition at Paris, I am not disposed to take an alarmist view of the matter, though agreeing in the main with my old friend, Dr. Lyon Playfair, while industries, pursued successfully in Great Britain, were practically unrepresented, or so miserably illustrated as to be more vexatious than anything else. This arose partly from want of space, but chiefly, I fear, from apathy, or lack of public spirit on the part of our manufacturers. Many important intending exhibitors withdrew from the inadequacy of the space allotted to them. They could afford to be unrepresented rather than misrepresented. The great lesson to us, as derived from this Exhibition, is the enormous progress made by our continental neighbours, and their advance towards ourselves in things in which we have hitherto been supreme. The problem to be solved is, how to keep the foremost position in the race of improvement in all honourable rivalry? If this leads us to revise our system of primary education, and establish a sound system of scientific and artistic training, it will have been proved to be a great national boon. To stand still, or move slowly, is to be left behind.

INDUSTRIAL EDUCATION OF FOREIGN AND ENGLISH WORKMEN.

The following speech was delivered by Samuel Smiles, Esq., C.E., at the annual soirée of the Huddersfield Mechanics' Institute, held on October 31st, 1867; the Earl de Grey and Ripon in the chair:—

My Lord, Ladies, and Gentlemen,—The subject on which I propose to offer a few observations is that of technical education, and its application to the arts and manufactures. It is a very large and important subject. Great masses of our population, especially in these northern districts—which are the hives of manufacturing industry—depend for daily bread upon their employment in the arts and manufactures; and if it should turn out that their instruction as workmen, as foremen, or as masters is technically inferior to that of other nations, the consequences must eventually prove of a very serious character indeed. But is it the case that we have any reason to fear the competition of rival manufacturers in the markets of the world? Is it really so, that we, who have effected the most important mechanical inventions of the past century—who have given to the world the steam-engine, the locomotive, the spinning-jenny, the power-loom, the self-acting mule, the planing-machine, the steam-hammer, and a multitude of machines and tools calculated to facilitate production and expedite labour—is it possible that we can have any real grounds for fear from continental or other rivals? There can be no doubt that the impression is growing—rapidly growing—that this is really the case. It must, of course, be acknowledged that we possess the very best practical schools for workmen in our excellent workshops and manufactories. That is unquestionably an immense advantage. But although no technical education, however complete, will enable the artisan to dispense with the education of the workshop, without which no practical art can be thoroughly learnt—just as no amount of theoretical instruction in the art of riding will teach a man to ride so well as the back of a horse—yet it is every year becoming more clear that it is not only in the school of practice, but also in the school of science, that the advanced workmen must be trained. It is believed by those who have given the matter their careful attention, and are in the best position to form an unbiassed opinion upon it, that unless we make haste to educate our population at least up to the continental standard, our position as a manufacturing nation must before long become very seriously imperilled. Do not suppose that I am conjuring up an imaginary danger. I ask you to look the facts fairly in the face, and see how we now actually stand. Recollect that all the great inventions which I have cursorily mentioned—the steam-engine and its modifications—all our tools and machines—are now common to the world. Though mostly of English origin, they have become the property of the human race, and they are in use in nearly all civilised countries. For a long course of years past, during the last century at least, we have enjoyed certain special and local advantages. We were separated from Europe by many miles of deep sea, and enjoyed the blessings of peace within our borders, while most of the continental nations were worrying each other and ruining each other by war. We have had abundance of coal, iron, and hard-working men; and we have had the advantage of the first use of the great inventions of the last century, which gave us a start in the race that we have kept till now. But it must be confessed that those special and local advantages which we have heretofore enjoyed have in a great measure ceased. Other countries have enjoyed the benefits of a long peace. Belgium, France, and Germany, like us, possess coal, iron, and hard-working men. They, too, make use of all our tools, engines, and machines, which they are constantly improving upon; and it is tolerably clear that unless we bring up our industry by dint of speed, superior skill, and superior science, our advantages will in a great measure cease. England having adopted free trade, and thrown her ports open to the world, has at the same time thrown her various branches of industry open to the competition of the world; and if the manufacturers of Belgium, France, and Germany can make cheaper machines, or cloth of silk, woollen, or other fabrics, they may compete with us in all foreign markets, and undersell us even in our own. Under the system we have adopted, they are as free to do so as are the corn-growers and cattle-breeders of Russia, Holstein, the United States, and other countries, to undersell our farmers in Smithfield and Mark-lane. Free trade has thrown our markets open to the world. Foreigners have seen with envy, and very properly do their best to rival, the manufacturing prosperity of England.

All the States I have mentioned have founded what are called trade schools, in which the principles of mechanics, chemistry, and physics—the nature and qualities of raw materials, and the *rationale* of the processes by which they are converted into manufactured articles—are carefully taught by thoroughly qualified teachers. Such schools also exist in Switzerland, Austria, and the states of South Germany. Fifteen years ago, as I find from a report on the subject published by our own Government, the trade schools of the comparatively small kingdom of Bavaria were 26 in number, with 221 teachers and 11,579 pupils. I hold in my hand prospectuses of the technical schools of Mulheim, Crefeld, and Elberfeld, on the Rhine, three towns very similar in character to Huddersfield, from which it would appear that the instruction given in them is of the most complete character. I will leave the prospectuses with your secretary, and I shall be glad if some member of the German class, if you have one, will translate them for the benefit of the members. The French have also, of late years, paid great attention to the industrial education of their artisans. They have established technical schools of all kinds with that object. At Paris, there is the school of the Conservatoire des Arts et Metiers for the free education of skilled artisans, and the Central School of Arts and Manufactures for higher class pupils. I find it stated in a letter of Dr. Lyon Playfair to the chairman of the Schools Enquiry Commission, of which Mr. Baines is a member, that when M. Dumas, the French Senator and *savant*, in going through the Paris Exhibition, came to anything excellent in French manufacture, his invariable question was—"Was the manager of this establishment a pupil of the School of Arts and Manufactures?" and in the great majority of cases he received a reply in the affirmative. At Lyons, the School of St. Pierre gives first-class instruction, gratuitously, to about 200 students. One of the branches taught is the application of art to the silk manufacture, and the instruction of the students in the method of transferring the productions of the artist to the loom of the weaver. This school is constantly sending forth a number of young men highly educated in all the arts applicable to the silk manufacture, as regards the preparation of the raw material, dyeing, and designing of patterns. And by this means Lyons is enabled to keep the lead of the world in this branch of production, the only town running it close being Crefeld, where there is a similar school. The municipality of Lyons gives 20,000 and the Government of France 20,000 francs annually for the maintenance of this institution. Roubaix, in the North of France, which comes closely into competition with Bradford, besides educating the whole children of the commune gratuitously in common day schools, has efficient technical schools for the advanced instruction of the workmen. I saw, the other day, a great pile of goods from Roubaix, in the warehouse of a gentleman in the City of London, who had, until recently, a factory for the making such goods at Glasgow, which he has now closed. At the Chalons-sur-Marne Public School of Art and trades, 450 pupils are maintained at the expense of the Government, besides those who pay for their instruction. Let me tell you that the masters there, the employers of labour, are as anxious for instruction as the working men themselves. While the working class organizations of this country are enacting regulations far the limitation of skill—so that the standard of work shall be not that of the best, but of the most ordinary workman—the foreigners are stimulating the skill of their workmen, rewarding those who excel in it, and in all ways actively promoting the industrial education of their people. Now these are serious facts, and it is right that we should look them fairly in the face. Is it not full time that we took a lesson from them? for if we are to maintain our position, we, too, must educate our working men, who for energy, industry, and natural capability are unequalled in the world.

So long ago as the year 1851, Mr. Moseley, one of our Government Education Inspectors, made this remark in his report:—"There is good reason to believe that unless measures be taken for the better instruction of the workmen in England, our neighbours will gain that advantage over us in the scientific character of their machines, which they have confessedly done, by means of their drawing schools, in the arts of design." Fifteen years ago, principally through the instrumentality of Prince Albert, schools of design were established, and have worked most satisfactorily in all the large towns. The results have been admirable, yet we are not supposed to be an artistic people. The French even say that our English ladies do not know how to put on a shawl. Yet these schools have shown, and our works of art show, that we have in us the germs of art; and that art as applied to manufactures, has rapidly improved in England of late years, was distinctly admitted by M. Chevalier, in his report on the English Exhibition of 1862. Dr. Lyon Playfair, shortly after the Exhibition of 1851, expressed the same alarm as Mr. Moseley did, lest England should be falling behind in consequence of the want of efficient instruction of our workmen. He pointed out that the special advantages which England possesses as a manufacturing nation have, in a great measure, ceased; that the facilities which now exist in the means of communication between countries have placed most European nations nearly on a level as regards the supply of the raw materials of manufacture; that competition in industry is year by year becoming more and more a competition of intellect; and that the nation which most quickly promotes the intellectual development of its artisans must, by an inevitable law of nature, advance, while the country which neglects its industrial education must, by the same law, inevitably recede.

Since the opening of the present Paris Exhibition, Dr. Playfair, who was one of the jurors, has reiterated his opinion in a letter to Lord Taunton, chairman of the Schools Enquiry Commission, until recently sitting in London; and he alleged that from all that he saw and heard at Paris, he was convinced that the foreign manufacturers were making much more rapid progress than we were, and that the chief cause lay in our neglect of industrial education, to which the foreigners were paying such constant and sedulous attention. A copy of Dr. Playfair's letter was sent by the Commission to a number of the more eminent English jurors, for their opinion upon it, and their replies have been published. Those opinions are of a very startling character, and calculated, if anything can do so, to rouse us from the state of placid content into which we have fallen as to our unapproachable superiority as a manufacturing nation. I will quote a very few of them. Professor Tyndall acknowledges that "the facilities for scientific education are far greater on the Continent than in England, and where such differences exist, England is sure to fall behind as regards those industries into which the scientific element enters. In fact," says he, "I have long entertained the opinion that in virtue of the better education provided by continental nations, England must one day—and that no distant one—find herself outstripped by those nations, both in the arts of peace and war. As sure as knowledge is power, this must be the result." Then, the late excellent president of your institution, Mr. Huth, speaking on a subject with which no one can be more practically conversant, expresses his "fear that the enormous strides that have of late years been made by our continental rivals in France, Belgium, Prussia, and Austria, will daily make it more difficult for our woollen manufacturers to hold, not only their former prominent position, but even in many cases to maintain their present one;" and he adds—"From all I could see and learn, I found both masters and foremen of other countries much more scientifically educated than our own. This, however, is not all. The workmen themselves of other countries have a far superior education to ours, many of whom have none whatever." As regards mechanical engineering, in which England has heretofore reigned supreme, Mr. Fowler, the president of the Institute of Civil Engineers, concurs with Dr. Playfair in the opinion that "foreign nations have made greater manufacturing progress than England since the Exhibition of 1851;" but Mr. MacConnell, the eminent locomotive engineer, goes much further. Speaking of the foreign locomotives which he saw at the Paris Exhibition, he says:—"I am firmly convinced that our former superiority, either in material or workmanship, no longer exists; in fact, there are engines shown there, made in France and Germany, equal to those of the best English makers;" and he adds, "it requires no skill to predict that, unless we adopt a system of technical education for our workmen in this country, we shall soon not even hold our own in cheapness of cost as well as in excellence of quality of our mechanical productions." That Mr. MacConnell was fully justified in making this statement, is proved by the fact that since his letter was sent in, the Schneider firm at Creuzot, in France, have obtained a contract from Russia for 80 locomotives, which before would most probably have come to England.

A few words about this great Creuzot manufactory. It employs no less than 9,950 workpeople. The blast furnaces produce 130,000 tons of pig iron yearly, and the forges produce 110,000 tons of wrought iron, which is worked up into engines—locomotive, marine, and fixed—as well as machines of various kinds. The workshops of construction alone turn out engines and machinery of the annual value of about £560,000. Indeed, Creuzot is one of the largest manufactories in France. I do not know whether that of Krupp, at Essen, be larger: that, also, is a gigantic manufactory, employing many thousand workpeople. But another important feature of Creuzot, is the complete system of instruction provided for the workpeople in the technical schools of the place. At the Paris Exhibition there was an entire building occupied by the engines and machines of the establishment, together with models and drawings showing the arrangements of the schools as well as the proficiency and progress of the pupils. And it is clearly shown that those pupils who most successfully availed themseles of the instruction provided for them, are those who take the highest moral and social position, and rise to the highest ranks as workmen, foremen, clerks, superintendents, and engineers. But this, of course, was only what was to have been expected.

Another circumstance is worthy of being mentioned in passing. The foreign workpeople seem to get more good out of their wages than ours do. Being well educated, they are able to live more comfortably and more intelligently than if they had received a narrow education. The effect of improved culture is not only to render artizans more skilled as workmen, but to raise them in the social scale and to elevate them in the dignity of thinking beings. That the workmen of Creuzot are well conditioned and provident, is proved by the circumstance that of the persons employed there, 540 had

£97,469 deposited in the works' bank in 1866, while 1,230 possessed fixed property in dwellings and land worth the annual value of about £28,000, besides their wages. There is a passage I would like to read to you from the letter addressed by Mr. Mundella, of Nottingham, to Lord Taunton, which is very instructive on this point. He is a very large hosiery manufacturer, employing about 5,000 workpeople, with establishments at Nottingham, Derby, and Loughborough, as well as Chemnitz and Pausen, in Saxony. He says—"The contrast betwixt the workpeople of England and Saxony, engaged in the same industry, is most humiliating. I have had statistics taken of various workshops and rooms in factories in this district (Nottingham), and the frightful ignorance they reveal is disheartening and appalling. I was born and educated amongst the working classes, and all my life have been in close association with them, but I have never realised the condition of the lower masses of our workpeople till I took the pains to examine them personally in the manner I have indicated. In Saxony, our manager, an Englishman of superior intelligence, and greatly interested in education, during a residence of seven years, has never yet met with a workman who cannot read and write. And this not in the limited and imperfect manner in which the majority of English artisans are said to read and write, but with a freedom and familiarity that enable them to enjoy reading, and to conduct their correspondence in a creditable and often superior style. Some of the sons of our poorest workmen in Saxony are receiving a technical education at the Polytechnic schools such as the sons of our manufacturers cannot hope to obtain." Permit me also to quote one more passage from the letter of Mr. Huth to Lord Taunton, where I think he hits the nail on the very head. He says—"Of what use is an industrial scientific education to our working population if they have not had a good elementary education to begin with? . . . . . Let this national elementary education once be established throughout the country and you have a fine nucleus for scientific industrial schools, in nearly all our manufacturing towns at least, in our Mechanics' Institutions, wherever such Institutions are properly conducted." If you will allow me to make an observation on your Institution—which is one of the best and most efficient of its kind—not with a view to disparage your labour, but with the object, if possible, of elevating you into a higher path of work, it would be this—you are at present occupied for the most part in imparting the elementary education which ought to have been given at school. The true work of Mechanics' Institutes is something higher than teaching reading, writing, and arithmetic. I hope the day will come when they will not be merely elementary schools to teach grown-up persons what they ought to have been taught in youth, but scientific institutions giving scientific instruction to the higher class of workmen throughout the country. There is, perhaps, no nation in the world that can show so many brilliant instances as ours does of men sprung from the ranks of the working class, who, in the face of difficulties apparently insurmountable, have raised themselves to the highest positions as inventors, discoverers, and leaders of industry. But it must be acknowledged that these are exceptional cases. Such men as Arkwright, Brindley, and Stephenson, did not possess such advantages as every member of this Institution possesses in your excellent classes and library. They went groping after knowledge, as it were, in the dark, often stumbling, but rising again, and conquered success only by dint of valorous self-help, unfaltering industry, and indomitable pluck. But with the great mass of the people, who stand outside the domain of knowledge, the case is very different indeed. They must be helped to help themselves; and this can only effectually be done after a well-devised plan and system, which it is the business of society, acting through its organised instrument—the Government—to arrange and settle. And I cannot but regard it as a bounden duty on the part of society that it should actively endeavour to remove, so far as it can, the obstacles which stand in the way of social elevation, and in fact the civilisation, of the poorer classes of society—of which one of the greatest unquestionably is their want of efficient culture in youth. That the poor boy should be started on the road of life with his poverty is burden and calamity enough, but that he should be started also with ignorance, is a still heavier burden and a still greater calamity. As regards natural capability, no nation in the world can surpass our own. For industry and energy there is perhaps no people to equal the English. But they must be trained and disciplined to work intelligently, or their natural advantages will prove of comparatively little avail. What Opie, the painter, once said to a youth who asked him how he mixed his colours, applies to all skilled industry:—"I mix them with my brains, sir," was the reply. And unless the English artisans, like the foreigners, are taught to mix their brains with their work, it is inevitable that they must fall behind in the race of competition with the world.

PARIS ASSOCIATION FOR THE SECONDARY EDUCATION OF GIRLS.

It has for some time been a source of complaint that no opportunities of secondary education are offered to the female children of Paris. M. Duruy, the minister of public instruction, has now taken the matter in hand, and addressed a circular to the rectors of universities, inviting them to encourage the establishment of female classes with the aid of the professors of the Lycées. In cases in which the local authorities provide rooms for such classes, the minister of public instruction will supply the necessary materials of education.

In consequence of these circulars, the association in question has been formed, the members being professors of the universities or of public or private schools, including M. Milne Edwards, and other members of the Institute, to whom are added M. Viollet le Duc, the architect and inspector-general of historic monuments, and one lady, Madame Pape-Charpentier, directress of the normal classes of the Salles d'Asile.

The courses of study to be established by the association are to be held at the Sorbonne, and were to commence on the 1st of December. The courses, which occupy three years, will include literature, history, geography, domestic economy, the elements of jurisprudence, natural sciences, physics, and some branches of mathematics. There are to be two terms per annum between the 1st of December and the end of May; the lessons to take place three times a week, one on literature and one on science, each restricted to one hour in length, to follow immediately after each other. The pupils are to write exercises either upon the subject of the lesson, or other subjects given by the professor; these exercises are to be corrected and annotated, and finally there will be exercises, compositions, and examinations at the end of each academical year. These are not compulsory except for those pupils who compete for the medals or other awards to be given by the association. In the three years the pupils will have gone through nearly the whole course of instruction given at the Lycées, and may obtain on examination the same diploma as is given to the young men who have finished their education at a lycée in a satisfactory manner. The professors appointed for the first year are Madame Pape-Charpentier, for domestic economy; M. Philippon, secretary of the faculty of sciences, and M. Salicis, of the Ecole Polytechnique, mathematics; M. Albert, of the Lycée Charlemagne, literature; M. Hébert, of the faculty of sciences, and M. Duchartre, of the Institute, natural history; M. Gérardin of the Lycée Saint Louis, history of France; M. Cahors, of the Ecole Centrale, chemistry; M. Levasseur, of the Lycée Napoleon, geography; and M. Jamin, of the Ecole Polytechnique, physics. It will be seen by the above list that the association starts with a strong corps of professors.

The fee is fixed at 75 francs (£3) for each pupil per term, and each may be accompanied by her mother, governess, or schoolmistress.

Fine Arts.

EXHIBITION OF FINE ARTS, MADRID.—Heretofore, the Madrid exhibitions have been confined exclusively to native artists, but it is said that the directors of the Academy of the Beaux Arts have come to the determination of admitting in future the works of foreign artists, and that the regulations will shortly be announced.

STATUE TO THE LATE PAINTER INGRES.—A public subscription, amounting to four hundred pounds, has been made towards the erection of a statue of the late painter, Ingres, in his native town, Montauban; the council of the department, Tarn and Garonne, has voted a sum equal to £320; and the municipal council of Montauban will defray the rest of the expense. The statue is to be in bronze, the work to be thrown open to competition, and the Academy of the Beaux Arts of Paris to be invited to adjudicate.

DISCOVERY OF A SAXON RING.—The *Leeds Mercury* gives an account of a fine specimen of one of these rings, which has been discovered in a field near Driffield, in a singular manner. A man was ploughing, when he felt a slight obstruction to the plough. On searching for the cause, he found that the point of the plough-share had entered the opening of a large and valuable finger-ring. On examination it appeared to be of massive and pure gold, and of elegant manufacture. It weighs an ounce and a quarter, and contains gold equal to five sovereigns. The face is oval, and surrounded by a band, composed of small globules. Within this band the space is divided into four geometrical parts. The four upper divisions contain each an initial letter, and the cavities are filled with black enamel. The under curves contain each an ornament resembling a figure of 8, or a semi-true-lover's knot. The signet or design, which appears to have occupied the centre, is unfortunately lost, and nothing remains but the plain circular plate to which it has been pinned; a portion of the pin and the cavity in which it is inserted still remain, showing how it has been attached. The hoop or connecting band of the ring is formed of a grotesque nondescript animal's head, similar to the gargolls or heads we frequently see on Saxon and Norman churches. The remainder of the band consists of lozenge-shaped ornaments and a centre-piece, on each of which is an initial letter, and the interstices are filled with black enamel. This ring is probably purely Saxon, and, from its size and the rich character of the workmanship, must have, in its time, adorned the finger of some distinguished individual, and it is at least twelve hundred years old. Driffield is reported to have been the royal residence, and the church at Little Driffield contains the body of one of the Saxon kings.

Manufactures.

MANUFACTURE OF LEATHER IN ITALY.—The manufacture of leather is one of the most important among the national industries of Italy. The number of leather manufactories in this kingdom amounts to 1,175, employing about 12,500 workmen, and producing about 282,346 cwt. per annum, to the value of two millions and a half sterling. In this manufacture Piedmont and Liguria occupy the first place, afterwards the Neapolitan provinces, then the Venetian provinces for £360,000, then Lombardy for £340,000, and finally Tuscany, which produces leather to the value of £240,000 per annum. The island of Sardinia does not produce leather, but exports to the main land hides to the amount of £44,800. Upwards of 190,000 cwt., estimated at about £920,000, are annually imported from America, England, France, and Austria. The exportation of leather from Italy is very small indeed, whilst, on the other hand, the importation from France amounts to £160,000. The tanneries in Italy are abundantly supplied with water and materials used for tanning, which, if properly developed, might produce sufficient to prevent any importation from abroad being necessary. The art of making parchment is carried on to a large extent at Arpino and Sulmona, from whence are exported annually about 6,600lbs. The manufacture of glue is extensively carried on at Chieti. In Piedmont a glue called French glue is made, treating the bones with muriatic acid. Of this 88,000 lbs. are exported annually. Naples, Genoa, Turin, and Venice are famous for their manufactories of gloves. Those of Naples are preferred for their good quality and cheapness, and are even exported to America. Some are so fine as only to weigh little more than an ounce per pair, and three pairs may be put into a walnut-shell. Naples exports yearly 32,644 dozen pairs of gloves, of the value of £6,000, whilst 15,000 dozen pairs are exported from Genoa, and about the same amount from Turin. At Venice about a thousand persons are employed in this manufacture. Allied to the manufacture of leather is that of bootmaking, which, after supplying the wants of the country, produces a considerable quantity for exportation. At Genoa there is an establishment for bootmaking by machinery, with branches at Naples and Florence, at reasonable prices. The total exportation of boots may be estimated at 121,000 pairs, of which 56,000 are sent to England, 45,000 to South America, 12,000 to Turkey, and 8,000 to France. In Italy there are 1,500 manufactories of hats, of which the principal are at Turin, Milan, Florence, and Naples, but the best hats are imported from France, and this industry is capable of great improvement to be able to prevent this importation.

Commerce.

IMPORTATION OF CATTLE TO MARSEILLES.—There has been a considerable increase in the importation of cattle to the port of Marseilles in the first nine months of the present year, as compared with a similar period of last year. The number of bullocks imported from Sardinia was 23,796, and 25,887 from Algeria, altogether 49,683, against 24,685 imported during first nine months of 1866. The importation of sheep has nearly doubled. During the first nine months last year it amounted to 130,794 head; this year, for the same period, 259,194 head were imported. The number of sheep imported from Italy has not increased, but the quantity obtained from Algeria has been nearly doubled. As to bullocks, the importation from Sardinia is doubled; and besides, 2,564 cows have been imported from that country.

FRENCH CUSTOMS' RETURNS.—The official returns for the first nine months of the year have recently appeared. The imports of alimentary substances exceed those of last year by nearly six millions sterling, five-sixths of which consist of grain and dry vegetable substances. Under the head of principal natural products and materials of industry, the imports were 1,542¾ millions of francs, against 1,484½ millions in 1866, or an excess of 2⅓ millions sterling; the principal augmentation being in horses, skins, and furs, wool, silk, flax, guano, forage, oleaginous and other seeds, and spice; while there was a notable diminution, on the contrary, in cotton, silk-worms' eggs, leaf tobacco, and petroleum. The imports of manufactured articles amounted to 174¾ millions, against 178 millions of francs, or an increase of £270,000; the chief objects of increase being linen yarns, hemp and jute, linens and silks, prepared skins, and watch and clockwork; while there was a decrease in the case of woollen yarns, straw and bark mats, machinery and iron ships; the imports of miscellaneous articles were 90½ millions, against 88 millions of francs, showing an increase of £100,000. The total of the imports of 1867 therefore shows an increase, as compared with the nine months of 1866, equal to £11,040,000. The exports exhibit a contrary aspect, those of the present year amounting to 2,197 millions, against 2,375⅓ millions of francs in 1866, giving a difference equal to £7,120,000. The list is completed by the return of the movements of precious metals, of which the excess of entries over exports was 404½ millions in 1867, against 467¾ millions in 1866, or a diminution of £2,560,000.

Colonies.

EXPORTS TO, AND IMPORTS FROM, THE COLONIES.—The value of the exports of British produce and manufactures to the Australian colonies during the eight months ended August, 1867, are stated to be £5,850,875, which amount shows a decrease of over three millions on those of last year for the same period, distributed as follows:—

	1866.	1867.
Victoria	£4,017,995	£2,732,090
New South Wales	1,963,318	1,204,696
New Zealand	1,296,874	979,154
South Australia	1,024,564	526,590
Queensland	349,109	192,302
Tasmania	150,364	153,172
West Australia	81,614	62,871
	£8,883,838	£5,850,875

The total value of the gold bullion and specie imported from Australia and New Zealand during the past nine months of the present year, was £3,863,970, against £4,639,371 in the same period of 1866. The following is a list of the principal articles of Australian produce imported into the United Kingdom during the nine months ending 30th September, as compared with the corresponding period of last year:—

	1866.	1867.
Wool	102,047,664 lbs.	118,672,805 lbs.
Copper ore	12,671 tons	10,839 tns.
Copper, wrought	56,060 cwt.	57,320 cwt.
Tallow	17,155 „	17,574 „
Hides, wet	71,387 „	53,944 „

194 vessels, with a tonnage of 176,300 tons, cleared out from the United Kingdom, against 280 vessels, with a tonnage of 260,189 tons, in the first nine months of last year; 160 vessels, with a tonnage of 139,178 tons, were entered inwards during the first nine months of the year, against 144 vessels, with a tonnage of 131,408 tons, in the corresponding period of last year.

Notes.

THE HALF-TIME SCHOOL SYSTEM.—The half-time school system now in course of extension in the manufacturing districts in England, is beginning to attract attention in France. An association has been formed recently there under the presidency of M. Dumas, of the Institute, for the amelioration of the condition of apprentices and young children engaged in manufactures. Upwards of two thousand persons have already joined the association as subscribing members. At the recent formal seance, presided over by the Empress at the Palais d'Industrie, a report was read from the officers of the association, which her Majesty has taken under her special patronage, urging the adoption of the principle of compulsory attendance of children at school three hours a-day, or the half-school time, as a security against bodily overwork, as well as against exclusion from education; and proclaiming the award of a medal to Mr. Edwin Chadwick as the originator and promoter of the system in England. In Canada and in Massachussetts, and in several of the United States, lectures have been delivered, chiefly from his papers, and the principle is in the course of adoption, chiefly in connection with a system of military drill and gymnastic training during the hours taken from the usual school time. Earl Russell, in his recent speech on a national system of education, referred to an address given at Paris by Mr. Chadwick to the Academy of Moral and Political Science of the Institute, as containing facts and reasonings which had convinced his Lordship that the half-school time system was an improvement in the method of instruction, which ought to be generally adopted in a national elementary system of education. In answer, the Duke of Marlborough, as Lord President of the Privy Council, stated, that the Acts for the regulation of factories recently passed, provided for its wide extension in the manufacturing districts, and that it had been referred to a commission to consider of its application to the elementary schools for children engaged in agriculture. It is estimated that under the recent Acts the half-time system will be eventually extended to about one million of children in the manufacturing districts. The last number of the *North British Review* contains an article on the military organisation of the country, urging the transference of as much as possible of military exercises from the productive or adult stages of life to the non-productive, or the school stages on the half-school time principle, as a means of spreading a predisposition to a better order of recruiting, and lessening the expense of military training.

NATIONAL DEBT OF AUSTRIA.—The official gazette of Vienna publishes the total amount of the national debt of Austria up to the 30th June of the present year, at 2,988,466,695 florins, (£298,846,669 10s.) The amount up to the 31st December 1866, being 2,919,717,680 florins, shows an increase in the debt for the first six months of the present year of 68,769,665 florins, (£6,876,966 10s.

TURKISH RAILWAYS.—An important network of railway has just been conceded by the Turkish Government to a French and Belgian Company. This line will put Vienna and Constantinople in direct communication with each other. The total length of the main and branch lines will be about 1,200 English miles. From Constantinople the line will pass through Adrianople, Sophia, Nissa, Belgrade, and will be united with the network of European railways at Basiasch. Branch lines will be constructed from Constantinople to Enos, and Nissa to Salonica. The works between Belgrade and Nissa will be commenced during the present winter.

Correspondence.

THE RECENT MONETARY CONFERENCES.—SIR,—The reading and discussion of my paper on Wednesday, the 27th ult., were protracted till too late in the evening to allow me to answer the observations made upon it. Will you allow me to do so as briefly as possible? I may no more than Mr. Hendriks attach much weight to the report of the Royal Commissioners of 1855, seeing that they were so few in number, and the task virtually fell upon one only, who entered into the inquiry with dispositions not very favourable to decimalisation; but no one can read the three folio volumes they have issued without being convinced that the question was at least well sifted. To my mind their verdict upon the pound and mil scheme is final. Only incidentally, the Commissioners for the restoration of the standards of weight and measure of 1841 suggested the great advantage that would result from decimalising the pound by dividing it into 1,000 mils. But they did not enter into the subject. The Committee of the House of Commons of 1853, presided over by a decided friend of that scheme, having examined scarcely any other witnesses than promoters of the same, concluded, upon imperfect information, that this was the only way to a decimal system. But when Lord Overstone's Commission summoned the opponents as well as the friends of that scheme, and the views of both were duly balanced, it was found that the advantages of taking the pound as a basis of decimalisation were greatly exceeded and counterbalanced by its defects and inconvenience. Many, no doubt, think that if we maintain the pound in its integrity the greatest difficulty of a change is overcome; but in this, as in many other things, the shortest is not always the most direct way. Why is it that more than twenty-five years have elapsed since the scheme has been advocated, and yet we are not farther advanced at this moment than ever we were? Simply because insuperable obstacles rendered it unpopular and impracticable. It is a grave fault of the scheme, that it touches the penny, which regulates so many transactions, and is perhaps the most familiar coin in the realm. Say what you will, it would be a burden to bring into all calculations the 1,000th part of the unit. With three decimals to carry in every summation, the labour and time required in calculation would not be less than with the present system. The cent is too large for a copper coin, too small for a silver one, and it is no light defect that very few of the existing coins would find their exact equivalents in the new system. Would it not be better that the friends of decimalisation should endeavour to find some other method for attaining the great desideratum? It is to be regretted that many, whose name and influence would be of immense advantage to the solution of the problem in some more practical way, still cling to a scheme which may be called defunct, and that overlooking all that has been said against it, when discussed for national purposes, now bring it forward afresh in an international aspect. The conferences recommended the gold five-franc piece as a basis for international coinage, on the supposition that England might easily reduce the pound to the value of twenty-five francs, and America make her dollar equivalent to five francs. It is vain, however, to imagine that this method would give to the world a sound international system of coinage, and to England a perfect decimal numeration in currency and accountancy. Suppose Austria to coin a ten-florin piece, France a twenty-five-franc piece, and America a five-dollar piece, that would not produce uniformity of accountancy unless these nations agreed to make the twenty-five-franc piece the unit, divided into one thousand parts. But will Austria, France, and America abandon respectively their florin, franc, and dollar? No. And if not, then the only point of contact being in the highest coin, very little advantage indeed would result from it either to travellers or merchants in their international intercourse. We shall have still to reduce the dollar, florin, and franc into sovereigns; and with these, and many more units, I doubt whether we shall advance much towards a common system. It appears, moreover, that Austria never means to go farther than issuing the gold piece of ten florins, the Coinage Commissioners having reasonably objected to coin a piece of half that amount—viz., five florins, or twelve and a-half francs, and preferred to coin a four-florin piece, or ten francs. And as to France, she does not want a twenty-five-franc piece with the twenty-franc pieces in general use. If she issues it as a compliment to this country, she will soon find the demand for such a coin so small that it will not be worth while maintaining it even in internal circulation. Nor is it so easy for the country to reduce the pound to the exact equivalent of twenty-five francs, as might at first sight appear. The pound being now worth 25·20 francs, could not be declared by law to be 25 francs; and I have great doubt that the Government will be prepared to reduce the standard of the pound to meet this agreement. If the plan were otherwise acceptable, the only way would be to issue a new sovereign of that value. But what shall we do with the hundred millions of sovereigns in circulation? They must all be withdrawn, since it would never do to have two sovereigns, differing so little, in circulation at the same time. When I went to Paris to assist at these conferences, all these difficulties pressed upon my mind, and feeling that it was absolutely necessary to propound a plan which might be adapted to the five-franc piece, as suggested by the Conference, I came to the decided conviction, after the closest investigation, that the very best we can do is to take the ten-franc piece as the future unit for British coinage, in the shape of a coin representing one hundred pence, divided into ten new silver tenpence pieces. This plan would have all the advantages of the tenpenny scheme, so warmly and so ably advocated years ago by Mr. Rathbone, Dr. Gray, Mr. Slater, Mr. Yates, Mr. Minasi, and many others, and would have the additional element of internationality, which we are now seeking. The supposed difficulty of converting the present coinage into the new system, and *vice versa*, is, I apprehend, greatly exaggerated. Mr. Fellows and other friends justly say, how do you dispose of the difference between the British and French standards? I know full well that we cannot get over this, whichever plan we take; but there is this difference in favour of my plan, that whilst by reducing the sovereign to the value of twenty-five francs, you operate directly on the pound, and create a necessary confusion between the new and the old pound, by introducing an intermediate coin, as a token only, in the first instance, you familiarise the people with the new system, and facilitate the preparation for the coming change. It is understood, of course, that when the one hundred pence, or ducat, is declared to be the unit, holders of sovereigns will be entitled, in changing them for the new coins, to be allowed the difference in the respective values, a proper table being issued by authority specifying the exact equivalents. Let me just add, that, with the ten francs scheme we can easily obtain a much higher unit than the pound for large transactions. Whether we should coin or not a ten-ducats piece, to be called a Victoria, by merely removing the decimal point to a higher figure, we have at once a unit equivalent to nearly four pounds sterling. A gold coin of eight shillings and fourpence is not quite new. The gold noble, current under the reign of Henry IV., was worth eight shillings and fourpence. Silver coins of tenpence and fivepence were issued in Ireland long ago. As to Mr. Muspratt's suggestion of combining the two modes—that is, to have the pound reduced to twenty-five francs, and a coin representing one hundred pence—the difficulty would be, that though we might have a coin representing twenty-five francs, or nearly equal to the sovereign, its divisions would not agree with those of the ducat—the tenth, hundredth, and thousandth part of the one having nothing in common with the tenth and hundredth part of the other. In the introduction of a new system of coinage, the great difficulty to be met with is to induce the masses to depart from standards with which they are familiar. Do not, then, touch the penny, which is the standard best known to millions of our working classes. As for the difficulty of re-arranging the terms of all pecuniary obligations, that is easily overcome, since it affects especially the middle and higher classes of society, who can readily make the necessary calculations, assisted as they will be by an abundance of ready-reckoners and tables of equivalents, and conversion.—I am, &c., Leone Levi.

10, Farrar's-buildings, Temple, 10th December, 1867.]

MEETINGS FOR THE ENSUING WEEK.

Mon......British Architects, 8.
Medical, 8.
Asiatic, 3.
Society of Engineers, 7½. Mr. James Gresham, "On the most recent Improvements in the Injector."
Tues ...Civil Engineers, 8. Annual General Meeting.
Statistical, 8. Mr. Jas. Heywood, "On the Form of Government and Educational System of the University of Cambridge."
Pathological, 8.
Anthropological, 8.

WED ...Society of Arts, 8. Mr. N. P. Burgh, "On the Principles that Govern the Future Development of the Marine Boiler, Engine, and Screw Propeller."
Geological, 8. 1. Sir J. Lubbock, "On the Parallel Roads of Glen Roy." 2. Dr. C. Collingwood, "On the Geological Features of the northern part of Formosa." 3. Dr. C. Collingwood, "On some Sources of Coal in the Eastern Hemisphere."
R. Society of Literature, 8½.
THUR ...Royal, 8½.
Antiquaries, 8½.
Chemical, 8. Mr. Alfred Tribe, "On the Freezing of Bismuth and Water."
Linnæan, 8. 1. Dr. Hooker, "*Fuchsia coccinea.*" 2. Mr. Jackson, "Japanese Pines." 3. Mr. Bentham, "*Myrtaceæ.*"
Zoological, 4.
Numismatic, 7.
Philosophical Club, 6.
FRI........Society of Arts, 8. (Cantor Lectures.) Professor Richard Westmacott, "On Art; especially including the History and Theory of Sculpture."
Philological, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 2nd December, 1867.*
15. Bill—Bank Holidays.
17. „ Local Officers Superannuation (Ireland).
18. „ Religious, &c., Buildings (Sites).

Delivered on 3rd December, 1867.
5. Bill—Burials (Ireland).
14. Public Income and Expenditure—Account.

Patents.

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From Commissioners of Patents' Journal, December 6.

GRANTS OF PROVISIONAL PROTECTION.

Boilers—3343—J. A. Hopkinson and J. Hopkinson, jun.
Boilers, supplying water to—3350—A. V. Newton.
Boots and shoes—3281—C. Mole.
Butter baskets—3269—J. Colebrook.
Chimneys, &c., cowls or guards for—3300—W. Blundell.
Coffins—3283—S. Coulson.
Cotton, &c., opening and cleaning—3263—E. Lord.
Cribbage boards—3326—T. Barton.
Engines, marine steam—3320—W. Macnab.
Engines, rotary—3334—A. V. Newton.
Engines, steam, &c.—3299—W. R. Green and J. G. Freeman.
Engines, &c.—3309—J. G. Tongue.
Envelopes—3342—C. E. Penny.
Evaporators—3277—W. Anderson.
Exhibitions, producing illusory—3297—S. and B. Barczinsky.
Fabrics, ornamenting—3357—A. M. Clark.
Fabrics, woven—3273—R. Ward and T. Travis.
Fabrics, &c., dyeing textile—3267—W. J. Hanson and J. C. Ellison.
Fire-arms—3308—J. Wormald and W. B. Dalton.
Fluids in process of decantation, changing the condition of—3315—W. Needham and J. Kite.
Food—3275—W. J. and A. Coleman.
Furnaces—3348—C. T. Higginbotham.
Furniture—3182—G. Ellis and M. Jacobson.
Girders, &c., piles for wrought-iron—3355—J. H. Johnson.
Goods, dyeing—3329—T. L. Greenwood.
Hinges, spring—3364—W. R. Lake.
Iron into blooms, converting—3352—E. H. Bentall.
Kitchen ranges—3327—F. Brown.
Knitting machines—3265—E. T. Hughes.
Lamp burners—3353—M. A. Hamilton.
Lamps—3110—H. Allman and F. N. Gisborne.
Lamps—3287—H. Greene.
Lamps—3303—E. Thorold.
Metals, coating and uniting—3340—J. P. Smith.
Metals, &c., coating—3288—C. de Lavenant.
Metals, &c., treating—3360—H. F. Gardner.
Motive power—3279—A. Barclay.
Motive-power—3319—W. Boulton.
Motive-power—3316—G. H. and E. Bolton, W. Whitthread, and T. Robinson.
Oils and spirits, treating—3191—F. L. de Gerbeth.
Packing cases—3328—G. Turner.
Paper, manufacturing—3347—J. Hudson, jun.
Paper pulp, preparing—3351—A. V. Newton.
Patterns, ruling ornamental—3322—S. Amphlet and J. B. Fenby.
Petroleum, &c., vessels for storing, &c.—3344—J. and J. Hinks.
Piston heads, packing for—3293—W. R. Lake.
Rabbits, &c., treating skins of—3349—J. H. Johnson.
Railway carriages, &c.—3261—L. and W. Brierley and J. Bonnell.
Railway rails—3325—M. A. Hamilton.
Railways—3362—J. McFarlane and G. Barker.
Roads, &c., watering and cleansing—3337—W. Sim.
Smoke, consuming—3289—J. Staincliffe.
Smoke, consuming—3314—G. D. Hughes.
Soda and potash—3295—J. Townsend.
Soda water, &c.—3307—V. Burchell.
Solid substances, apparatus for stirring, &c.—3124—A. McDougall.
Spinning, &c., frames—3242—R. C. Addy.
Steam generators—3321—C. E. Brooman.
Tobacco pouches—3341—E. Townshend.
Tobacco, twisting—3332—R. Ward.
Tools, couplings for boring—3285—T. H. Tilley.
Tools, cutting, &c.—3339—J. P. Smith.
Tyres—3356—W. Fowler and J. Griffiths.
Watches, &c.—3298—J. F. Watson.
Water-closets—3305—H. James and E. Drewett.
Whales, killing—3312—G. Welch.
Windows, &c.—3206—J. Carter and T. Chalmers.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Car and carriage trucks—3363—S. A. Chase.
Lubricating apparatus—3403—W. R. Lake.
Spindles—3432—J. Collingham and T. E. Smith.

PATENTS SEALED.

1213. A. Clark.
1324. A. Clark.
1584. R. Pollit.
1669. C. E. Giajola, J. H. Gray, and P. Martinengo.
1692. J. Turner & R. B. Dunnett.
1695. A. Parkes.
1696. R. E. Pepys and J. Warburton.
1699. W. French.
1704. F. B. Dœring.
1709. R. Hornsby, J. Bonnall, and H. Shield.
1719. W. Rowan.
1756. W. R. Lake.
1762. C. D. Abel.
1798. A. M. Clark.
1810. H. Oram.
1815. A. M. Clark.
1825. R. W. Morrell.
1948. J. McAdams.
2052. A. M. Clark.
2209. B. Dobson and W. Slater.
2568. C. Mather.
2792. H. Pinkus.

From Commissioners of Patents' Journal, December 10.

PATENTS SEALED.

1393. A. Clark.
1713. H. Fletcher.
1716. J. Thom.
1723. J. Cochrane.
1725. D. Crichton, W. Donbavand, and D. Crighton.
1729. T. S. Prideaux.
1730. E. T. Hughes.
1732. J. Holmes.
1733. F. B. Baker and L. Lindley.
1735. J. Glover.
1739. S. Tuddenham.
1742. S. E. Crow.
1758. L. J. Crossley and J. Sunderland.
1763. J. H. Johnson.
1767. F. B. Miller.
1768. I. G. Lloyd.
1827. S. Holman.
1939. T. Borlase.
1940. W. S. Scott and W. H. Steel.
1963. A. V. Newton.
2011. W. E. Newton.
2028. G. R. B. Amott.
2103. W. R. Lake.
2115. J. W. Butler & E. Edwards.
2228. W. Tranter.
2417. H. A. Bonneville.
2519. J. B. Handyside.
2707. J. Oxley.
2906. J. Oxley and G. Wilson.
3041. W. R. Lake.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2993. J. Soper.
3007. G. Wailes and B. Cooper.
3027. J. Yearsley & E. Timbrell.
3036. G. Dixon.
3046. R. Richardson.
3069. A. J. Sedley.
3078. R. Mathers.
3123. W. Cotton.
3059. E. Myers.
3065. W. Tongue.
3055. J. Livesey and J. Edwards.
3056. H. Wilson.
3066. T. H. Roberts.
3116. J. Ellis.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2957. W. P. Piggott.
2985. E. Morewood.
2989. H. Jordan.
3017. D. Annan.

Registered Designs.

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4903—Nov. 13—Improved combined chair and steps—A. E. Pierce, 109, Hatton-garden.
4904—Nov. 15—Snake puzzle—J. Jaques, 102, Hatton-garden.
4905—Nov. 21—The nonpareil pouch—C. H. Bartlett, 1, Noble-street, City, E.C.
4906—Nov. 21—An envelope—J. Smith and Co., 42, Rathbone-place, Oxford-street, W.
4907—Nov. 26—Tube respirator—W. E. Lowe, 8, Stafford-street, Old Bond-street, W.
4908—Nov. 26—The gas-light carbon burner—R. Pilkington, West Ham, Essex.
4909—Dec. 4—An improved water or gas cock—D. Clark, Canada Works, Birmingham.
4910—Dec. 6—Fastening for the doors or the internal partitions of portmanteaus, bags, trunks, cases, or boxes—W. Middlemore, Birmingham.
4911—Dec. 7—A match-box—Bell and Black, Bow-lane, Cheapside, E.C.